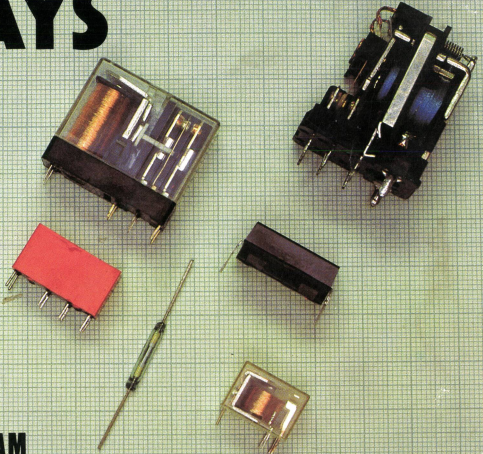
FEBRUARY 1984 **$2.35*** NZ $2.75

eti ELECTRONICS TODAY INTERNATIONAL

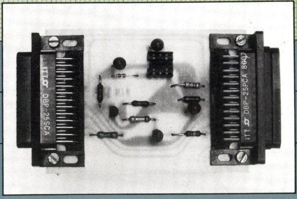
TOORAK
D $2.35
NEWSAGENCY

RELAYS

TECHNOLOGY -TECHNIQUES



HAM RADIO: A DX BEAM HEADING PROGRAM



TO BUILD:

MICROBEE TRUE RS232 INTERFACE

DIRECT-CONNECT MODEM REVISED

'DAMN FAST' NICAD CHARGER

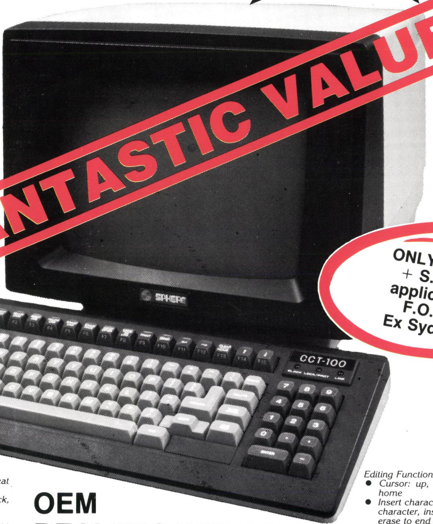
HI-FI: TECHNICS . PHILIPS . MARANTZ . CD PLAYERS REVIEWED

SPHERE COMPUTERS

PRESENTS AN INTELLIGENT TERMINAL

FANTASTIC VALUE

ONLY $799 + S.T. if applicable F.O.B. Ex Sydney



OEM DEALERS WELCOME

SPECIFICATIONS

Keyboard
- Detachable, capacitive, typewriter-style keyboard
- N-key rollover with auto repeat capability
- 4 LED indicators for caps lock, on line, block mode and keyboard lock/protect
- Audible keyclick enable/disable
- Auto repeat enable/disable
- Keyboard lock enable/disable
- Repeat rate 20 characters per second
- 5 cursor control keys, 10 editing function keys with 14-key numeric key-pad

Communication
- Code: 128 ASCII characters
- Baud rate: 75, 110, 150, 300, 600, 1200, 1800, 2400, 4800, 9600, 19,200
- Parity: Odd, even, mark, space
- Operating Mode: Full duplex, half duplex or block mode
- Interface: EIA RS-232C or 20-mA Current Loop

Emulation
- LEAR SIEGLER ADM-3A, HAZELTINE 1500, ADDS VIEWPOINT

Screen Presentation
- Display format: 24 lines x 80 characters
- Display unit: 12-inch, non-glare Green CRT
- Character type: 7 x 9 dot matrix
- Refresh rate: 50/60Hz
- Character set: 96 ASCII characters, 15 graphic symbols, 32 control character symbols
- 5 screen attributes: Blink, underline, blank, reverse, dual intensity
- Cursor type: Selectable slow, fast blinking or steady cursor, block, underline or invisible cursor

Editing Function
- Cursor: up, down, left, right, home
- Insert character, delete character, insert line, delete line, erase to end of line, page and field, field tab, field back tab, column tab, column back tab, block mode on/off, protect mode on/off, graphic mode on/off, clear unprotected.

External Control
- Power on/off
- Contrast adjustment
- Baud rate
- Parity and data format
- End of message
- Emulation mode
- Refresh rate
- Half duplex or full duplex
- Auto line feed
- Auto new line
- EIA or 20-mA Current Loop
- Reverse video or standard video

ENQUIRIES FROM: AVAILABLE FROM OFFICES AND SHOWROOM PARIS RADIO ELECTRONICS, SHOP 1, 165 BUNNERONG ROAD, KINGSFORD, NSW 2032. TEL. (02) 344 9111. TELEX AA22579.

EDITOR
Roger Harrison VK2ZTB
ASSISTANT EDITOR
Jennifer Whyte B. App. Sc.
EDITORIAL STAFF
Geoff Nicholls B.Sc./B.E.
Peter Ihnat B.Sc./B.E.
Jane Hodson
ASSOCIATES
David Tilbrook VK2YMI
Jonathan Scott
B.Sc./B.E. (Hons) VK2YBN
DRAUGHTING
David Currie
PRODUCTION
Steve Landon
Mark Davis
ADVERTISING SALES
Richard Pakalnis (Group Manager)
John Whalen (National)
Steve Collett
ART STAFF
Ali White B.A.
Bill Crump
READER SERVICES
Carmel Gatt
ACOUSTICAL CONSULTANTS
ouis Challis and Associates

HEAD OFFICE
40 Joynton Avenue, (PO Box 227)
Waterloo, NSW 2017.
hone: (02) 663-9999 Sydney.
elex: 74488, FEDPUB.

**DVERTISING OFFICES
ND AGENTS:**

ictoria and Tasmania: Virginia Salmon and
lel Godfrey. The Federal Publishing
ompany, 23rd Floor, 150 Lonsdale Steet,
lelbourne, Vic. 3000. Phone: (03) 662-1222
lelbourne. Telex: 34340, FEDPUB.

outh Australia and Northern Territory:
he Admedia Group, 24 Kensington Road,
ose Park, SA 5067. Phone: (08) 332-8144
delaide. Telex: 82182, ADMDIA.

ueensland: Geoff Horne Agencies, 16
ellbowrie Centre, Bellbowrie, Qld 4070.
hone: (07) 202-6813 Brisbane.

estern Australia: Cliff R. Thomas, Adrep
dvertising Representative, 62 Wickham
treet, East Perth, WA 6000. Phone: (09)
25-6395 Perth.

ew Zealand: Chris Horsley, 4A Symonds
ourt, Symonds Street, Auckland. Telex:
60753, TEXTURE.

ritain: Peter Holloway, John Fairfax and
ons (Australia) Ltd, Associated Press
ouse, 12 Norwich Street, London EC4A
BH. Phone: (01) 353-9321 London. Telex:
62836, SMHLDN.

apan: Genzo Uchida, Bancho Media
ervices, 5th Floor, Dai-Ichi Nisawa Building,
-1 Kanda Tacho 2-chome, Chiyoda-ku,
okyo 101. Phone: (03) 252-2721 Tokyo.
elex: 25472, BMSINC.

PROUDLY PRINTED
IN AUSTRALIA

ECTRONICS TODAY INTERNATIONAL
published monthly by the Electronics
vision of the Federal Publishing Company
y Limited, 140 Joynton Avenue, Waterloo,
SW 2017. Managing Editor: Bob Izzard.
peset and printed by ESN-The Litho Centre,
dney. Distributed by Gordon and Gotch
nited, Sydney. Cover price $2.35
aximum and recommended Australian
ail price only; recommended New Zealand
ce, $2.75). Registered by Australia Post,
blication No NBP0407. ISSN No
13-5216.

OPYRIGHT © 1984, THE FEDERAL
BLISHING COMPANY

FEATURES

NEWS DIGEST 8
RELAYS — TECHNOLOGY, TECHNIQUES 12

SIGHT & SOUND

SIGHT & SOUND NEWS 30
THREE NEW CD PLAYERS REVIEWED 37

COMPUTING TODAY

COURT DECISION PROMPTS SOFTWARE LEGISLATION 45
COMPUTING TODAY NEWS 48
SPHERE MKII COMPUTER REVIEWED 57
MICROCOMPRESSOR COURSE REVIEWED 61
PROJECT 676 FAIR DINKUM MICROBEE RS232 INTERFACE 64
PROJECT 644A REVISED DIRECT-CONNECT MODEM 72
YOU ROTTING SWINE! — A COMPOST CALCULATOR 75
MICROBEE COLUMN 80
VIC-20 COLUMN 82
'660 COLUMN 84

TECHNICAL

EQUIPMENT NEWS 93
COMPONENT NEWS 97
CIRCUIT FILE — USING THE LM335 100
PROJECT 274 DAMN FAST NICAD CHARGER 108
IDEAS FOR EXPERIMENTERS — BUMPER ISSUE! 116
IDEA OF THE MONTH 126
SHOPAROUND 128
OVER THE COUNTER 133

COMMUNICATIONS

COMMUNICATIONS NEWS 137
A DX BEAM HEADING CALCULATOR 140

GENERAL

COMMENT 5
ADVERTISERS' INDEX 5
MAIL ORDER BOOKS 129
MINI-MART 145
DREGS 146

COPYRIGHT: The contents of *Electronics Today International* and associated publications is fully protected by the Commonwealth Copyright Act (1968). Copyright extends to all written material, photographs, drawings, circuit diagrams and printed-circuit boards. Although any form of reproduction is a breach of copyright, we are not concerned about individuals constructing projects for their own private use, nor by bands (for example) constructing one or more items for use in connection with their performances. Commercial organisations should note that no project or part project described in *Electronics Today International* or associated publications may be offered for sale, or sold in substantially or fully assembled form, unless a licence has been specifically obtained so to do from the publisher, The Federal Publishing Company, or from the copyright holders.

LIABILITY: Comments and test results on equipment reviewed refer to the particular item submitted for review and may not necessarily pertain to other units of the same make or model number. Whilst every effort has been made to ensure that all constructional projects referred to in this edition will operate as indicated efficiently and properly and that all necessary components to manufacture the same will be available, no responsibility is accepted in respect of the failure for any reason at all of the project to operate effectively or at all whether due to any fault in design or otherwise and no responsibility is accepted for the failure to obtain any component parts in respect of any such project. Further, no responsibility is accepted in respect of any injury or damage caused by any fault in the design of any such project as aforesaid.

SERIES 5000

PRICES SLASHED

As designed by ETI

INDIVIDUAL COMPONENTS TO MAKE UP A SUPERB HI-FI SYSTEM. DIRECT IMPORT AND A MORE TECHNICALLY ORIENTED ORGANISATION BRING THESE PRODUCTS TO YOU AT LOWER PRICES THAN OUR COMPETITORS.

EXTRA FEATURES OF OUR KITS
POWER AMPLIFIER
KIT PRICE $319 P&P $12.00

Only $449

• 1% Metal Film Resistors are used where possible • Prewound Coils are supplied • Aluminium case as per the original article • All components are top quality • Over 400 Kits now sold • We have built this unit and so know what needs to go into every kit • SUPER FINISH Front panel supplied with every kit at no extra cost to you. • We are so confident of this kit that we can now offer it assembled and tested so that people who do not have the time can appreciate the sound that this amplifier puts out. This is done on a per order basis delivery approx. four weeks after placement.

PREAMPLIFIER
KIT PRICE $289 P&P $12.00

Only $449

• 1% Metal Film Resistors are supplied • 14 metres of Low Capacitance Shielded are supplied (a bit extra in case of mistakes) • English "Lorlin" Switches are supplied no substitutes as others supply • We have built and tested this unit and so know what needs to go into every kit • Specially imported black anodised aluminium knobs • Again as with the power amp we are offering this kit A & T at a price which we do not believe there is a commercial unit available that sounds as good. Same delivery as the PA.

PREAMPLIFIER Kit Price $289, P&P $12.00

SPECIFICATIONS

Frequency response:	High-level input: 15Hz-130 kHz, +0, −1 db Low-level input — conforms to RIAA equalisation, ±0.2 dB
Distortion:	1kHz <0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation).
S/N noise:	High-level input, master full, with respect to 300 mV input signal at full output (1.2V): >92 dB flat >100 dB A-weighted. MM input, master full, with respect to full output (1.2V) at 5 mV input, 50 ohm source resistance connected: >86 dB flat >92 dB A-weighted. MC input, master full, with respect to full output (1.2V) and 200 μV input signal: >71 dB flat >75 dB A-weighted.

On Special at $259
Normally $289

***All parts available separately for both kits.**

POWER AMPLIFIER Kit Price $319, P&P $12.00

SPECIFICATIONS 150W RMS into 40hms

Power output:	100W RMS into 8 ohms (±55 V supply).
Frequency response:	8 Hz to 20 kHz, +0−0.4 dB 2.8-Hz to 55 kHz, +0−3 dB. NOTE: These figures are determined solely by passive filters.
Input sensitivity:	1V RMS for 100W output.
Hum:	−100dB below full output (flat).
Noise:	—116 dB below full output (flat, 20 kHz bandwidth).
2nd harmonic distortion:	<0.001% at 1 kHz (0.0007% on prototypes) at 100 W output using a ±56 V supply rated at 4 A continuous. <0.003% at 10 kHz and 100 W.
3rd harmonic distortion:	<0.0003% for all frequencies less than 10 kHz and all powers below clipping.
Total harmonic distortion:	Determined by 2nd harmonic distortion (see above).
Intermodulation distortion:	<0.003% at 100 W. (50 Hz and 7 kHz mixed 4:1).
Stability:	Unconditional

Please note that the "Superb Quality" Heatsink for the power amp was designed and developed by Rod Irving Electronics and is being supplied to other kit suppliers. This product cost $1,200 to develop so that your amplifier kit would have a professional finish as well as sound.

On Special at $299
Normally $319

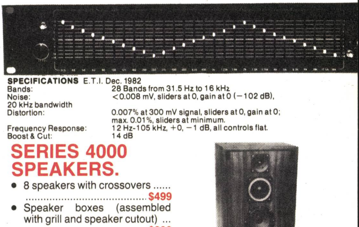
MX-1200 MICROPHONE/AUDIO MIXER

This unit features: 12 microphone line inputs with pan, bass, treble, effect and fold back controls for each channel • LED peak indicators for each channel • 2 turntable inputs with cross-fade and individual output controls • master equaliser for bass, midrange and treble • variable headphone output etc. etc. • complete with carrying case.

SPECIFICATIONS:
INPUTS
Level/Impedance Mic. .46 db/1K
Line .22 db/16K x 12
Phono .52 db/50K STEREO x 2 (.2mv) at 1KHz
Effect Return (Aux) .20 db/50K x 1
OUTPUTS
Level/Impedance L & R 0 db/2K
Effect Send 0 db/2K F/B Out 0 db/2K
Head phone Stereo +10 db/600 (100 .1K)
EQUALISATION
Channel
Bass ±15db
Treble ±15db
Master
Bass ±12db
Treble ±10db
Middle ±12db

FADER & CONTROLLERS
12 channel fader; Slide; 60m/m; LOG 25%
2 Master fader; Slide; 60m/m; LOG 15%
12 F/B Volume; 300; LIN
1 F/B Master level; 300; LIN
12 Effect Send; 300; LIN
1 Effect Return; 300; LOG 15%
2 Phono; 300; LOG 15%
1 Head Phone; 300; LOG 15%
S/N; 58DB
FREQUENCY RESPONSE: 20-20 KHz
TOTAL HARMONIC DISTORTION: Less than 0.1%
METER: 2 illuminated VU Meters 0db = 0.775V
PEAK INDICATOR: 12 LED Peak Indicators
VOLTAGE: 240 VAL 50Hz
POWER CONSUMPTION: 7.2 watts
DIMENSIONS: 620 (W) x 386 (D) x 108 (H) mm
(supplied complete with carrying case)

THIRD OCTAVE GRAPHIC EQUALIZER



SPECIFICATIONS E.T.I. Dec. 1982

Bands:	28 Bands from 31.5 Hz to 16 kHz
Noise: 20 kHz bandwidth	<0.008 mV, sliders at 0, gain at 0 (−102 dB),
Distortion:	0.007% at 300 mV signal, sliders at 0, gain at 0; max. 0.01%, sliders at minimum.
Frequency Response:	12 Hz-105 kHz, +0, −1 dB, all controls flat.
Boost & Cut:	14 dB

SERIES 4000 SPEAKERS.

• 8 speakers with crossovers	$499
• Speaker boxes (assembled with grill and speaker cutout)	$299
• Crossover kits	$199
• Complete kit of parts (speakers, crossovers, screws, innerband boxes)	$799
• Assembled, tested, ready to be hooked up to your system	$849

WE BELIEVE THAT WE ARE NOW THE ONLY ONES TO SUPPLY COMPLETE SPEAKER KITS ASSEMBLED AND TESTED FOR THOSE WHO HAVEN'T GOT TIME $849 EX STOCK.

PLEASE WRITE FOR CONSTRUCTION NOTES, THESE COMPLIMENT THE SERIES 5000 AMP RANGE AND ADD THE FINAL TOUCH.

ROD IRVING ELECTRONICS
425 High St., Northcote, Vic. 48-50 A'Beckett St., Melb., Vic.
Phone (03) 489 8866, (03) 489 8131, Mail Order Hotline (03) 481 1436
Mail orders to P.O. Box 235 Northcote 3070 Vic.
Minimum P & P $3.00. Errors & omissions excepted.

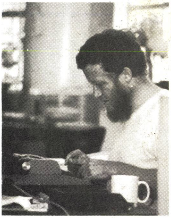
Please address tax exempt, school, wholesale, and dealer enquiries to
RITRONICS WHOLESALE
1st floor 425 High St. Northcote 3070 (03) 489 7099 (03) 481 1923
Telex AA 38897

ADVERTISERS' INDEX

ABC 133
AED 44
All Electronic Components ..117
Altronics 54,55
Acme Elect 99
Adaptive Elect. 43
Applied Technology 66,67
Aust. Government 18,19
Avtek Electronics 56
Dick Smith 86,87,88,89, 90,91,142,143
Electronic Dev. Sales 136
Elect. Components P/L 53
Electromark 136
Emona 127
Energy Control 59
George Brown Elect. 70,71
ICS 136
Imark 141
Infoware 59
Jaycar 6,7,68,70,71, 106,107,114,115,138,139
Lawrence & Hansen 29
Magmedia 44
McGraths 102,103
Micro 52
M. J. Pratt 59
Mini Tool 29
Nilson Rowe 119,121,123
Pre-Pak Electronics 113
Promark Elect 134,135
Powersonic 111
Radio Despatch 127
Rod Irving 4,46,47,60, 63,79,95,96,112,120,125,144
Rose Music 34,35
Rutty & Assoc. 29
Sanyo ....IBC
Scientific Devices 92
Scope Laboratories 11
Software Source 59
Sony (Aust) 33
STC Canon 23
Steward Elect. 98
Soanar 99
SWTPC ....IFC
Truscott Elect 136
Technico 17
Warburton Franki 24

PROUDLY PRINTED IN AUSTRALIA

COMMENT



The wise and prudent conquer difficulties by daring to attempt them.

— Rowe

RADIO AMATEURS have been involved in satellites and space communications experimentation since the very earliest satellites were launched. Their record of achievements in this area is something of which the amateur radio fraternity can be justifiably proud. Many 'firsts' have been established since OSCAR 1 (Orbital Satellite Carrying Amateur Radio) was launched in December 1961. The world's first free access active communications satellite was Oscar 3, launched in March 1965, one month before *Early Bird,* the first of the International Telecommunications Satellite Consortium (INTELSAT) satellites. The oscars were all largely the result of the efforts of a small group of US and European radio amateurs. A group of radio amateurs from Australia, all students then of Melbourne University, designed and constructed OSCAR 5 in the late 1960s which flew in January 1970. OSCAR 5 incorporated an innovative magnetic attitude stabilising scheme, another first; it was ground-controlled, was the first amateur satellite to have multi-channel telemetry, and established that the coefficient of solar energy absorption, then used by scientists for many years, was wrong!

Subsequent OSCARS have carried multiple transponders aboard and lasted years beyond their design lifetime. The latest, OSCAR 10, is in a highly elliptical orbit, permitting across-the-world contacts, between Australia and Europe, for example.

The latest amateur radio space venture though, is a whole new ball game. Owen Garriott, one of the scientists aboard the STS-9 mission Space Shuttle 'Columbia', happens to be a radio amateur and obtained permission to operate a VHF transceiver aboard the mission which flew late November last year. He managed to contact hundreds of amateurs in countries throughout the world during the few passes he was able to operate in the crowded scientific program. However, a group of Canberra amateurs, with the cooperation of Dr Garriott, the Department of Science and NASA, have achieved a commendable 'first' with the beginning of this new phase of amateur radio and space communications. They set up an experiment to prove that amateur radio could provide a viable backup communications system for manned space missions. They successfully established contact with Dr Garriott and, via a telephone 'patch' hookup, enabled him to talk with colleagues in the Lyndon B. Johnson Space Centre in Houston, Texas USA. There's a small news item on their achievement in *News Digest* this month and we'll bring you the full story next month. Don't miss it!

Roger Harrison VK2ZTB
Editor

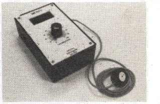
NEXT MONTH

CONTROL FOUR ROOM LIGHTS OVER A TWO-WIRE PAIR

It is probably a not-uncommon problem to want to replace the single ceiling light in a room with a more exotic dimmable arrangement only to find that the control wires to the switch are concreted in!
This project fixes that and provides two dimmable outputs plus two switched outputs, controllable over the existing two-wire pair between ceiling and wall switch.

DIGITAL EXPOSURE METER FOR PHOTO ENLARGING

Have you ever been caught with indecent exposure? Well, with this project you'll get a much higher yield of decent exposures from your darkroom. The project uses readily available components, is low in cost, simple to build and operate and includes a three-digit LED readout. The sensor provides 'cosine error' correction to account for the different illumination between the centre of the enlarger baseboard and the edge.



Although these articles are in an advanced state of preparation, circumstances may affect the final content. However, we will make every attempt to include all features mentioned here.

SERVICES

TECHNICAL INQUIRIES: We can only answer readers' technical inquiries by telephone after 4.30pm Mondays to Thursdays. The technical inquiry number is (02) 662-4267. Technical inquiries by mail must be accompanied by a stamped, self-addressed envelope. There is no charge. We can only answer queries relating to projects and articles as published. We cannot advise on modifications, other than errata or addenda. We try to answer letters as soon as possible. Difficult questions may take some time to answer.

GENERAL INQUIRIES: For all inquiries about back issues, subscriptions ($20.00 for 12 months/12 issues), photocopies of articles, artwork or submitting articles, call (02) 663-9999 or write to: ETI Reader Services, 140 Joynton Avenue (PO Box 227), Waterloo, NSW 2017.

CONTRIBUTIONS: Submissions must be accompanied by a stamped, self-addressed envelope. The publisher accepts no responsibility for unsolicited material.

GREAT NEW PRODUCTS

60-KEY COMPUTER KEYBOARD

- AS USED IN THE FAMOUS MICROBEE!
- SPST CONTACTS
- FRAME MOUNTED - QUALITY UNIT

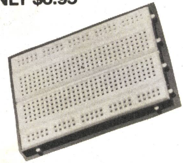
Cat. XE-3522

ONLY $29.95

MINI BREADBOARD

Just the right thing for many small projects. This board has the same features as our larger breadboards but measures a compact 80 x 60mm. It has 420 holes. Perfect for the occasional project.
Cat. PB-8808

ONLY $6.95

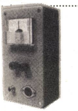


MICROBEE KITS

ETI 733 RTTY CONVERTOR. Ref: ETI April 1983

This simple project allows you to hook-up your MicroBee to a HF receiver and print radio teletype messages on a monitor screen. Listen to the world news FREE!!

Cat. KE-4654 ....ONLY $17.95



ETI 668 MICROBEE EPROM PROGRAMMER Ref: ETI February 1983

This simple, low cost EPROM programmer just plugs into the Bee's I/O port an d enables you to save programs in any of 5 different common EPROMs available (2716, 2532, 2732, 2732A, 2764). Kit comes complete with 'Personality' plug and all IC sockets.

Cat. KE-4650 ....$39.95

ETI 649 MICROBEE LIGHT PEN Ref: ETI Aug '83

This simple, low cost device plugs into the Bee's 8 bit port. The "pen" gives you an entry into the world of light pens and interactive software.

Cat. KE-4656 ....SHORTFORM $19.50

SPECIAL PROBE CASE TO SUIT (as specified in ETI article)

Cat. HB-6400 ....$19.95

PARALLEL INTERFACE KIT FOR THE MICROBEE

Includes 15 pin 'D' plug - add $15 if Centronics plug required.

Cat. KE-7017 ....$15.00

BARGAIN!

SPEEDO-CABLE TYPE SPEED SENSOR

This unit is designed to fit into a standard speedometer cable. It then provides a steady train of TTL-compatible pulses.

- As used in the EA Car Computer
- Used by State Police Force for electric speedo's.

A BARGAIN FEB ONLY $12.50

NORMALLY $29.95

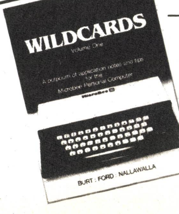
SAVE NEARLY 60%!!

SEALED PCB MOUNT ROTARY SWITCHES

We have decided to discontinue our range of open "skeleton" switches for these. The new switches have contacts enclosed in a fully molded plastic housing - reminiscent of European design rotaries. The silver plated contacts are terminated with PCB pins instead of the usual eyelet. You can solder to the pin, of course, but the pin also inserts straight into the PCB. Another feature of the switch is its programability. A removable ring with tab can be inserted into the switch several ways to yor particular requirements. For example, if you purchase a 1 x pole 12 way (max.) switch you could convert it to, say, 1 pole 7 way between stops. Versatile! Naturally the switches feature ⅜x32 TPI bush mount and a ¼" shaft with standard flat. The shaft is hard nylon moulded to help reduce signal capacitance problems. They are almost the same price as the inferior wafer units.

Cat. No.	Description
SR-1210	1 pole x 12 way
SR-1212	2 pole x 6 way
SR-1214	3 pole x 4 way
SR-1216	4 pole x 3 way
SR-1218	6 pole x 2 way

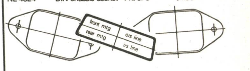
1-9 ONLY $1.95 ea
10« ONLY $1.75 ea


WILDCARDS
Volume One
A potpourri of application notes and tips for the Microbee Personal Computer
BURT · FORD · NALLAWALLA

WHAT ARE STICKIES?

As you can see, "stickies" are stick-on templates. Attach the template to a panel (note the crosshairs for accurate alignment) and proceed to cut out a perfect hole! The plastic film also protects the panel from scratches while you are working on it.
Stickies are available for the common irregular hole cutouts i.e. Cannon DB-25, XL series chassis plug and socket and IEC-320 chassis (mains) plug.

Cat. No. Price	DESCRIPTION	
NL-4010	25 way 'D' template - Pkt of 6	$1.95
NL-4014	XLR-31 series template - Pkt of 6	$1.95
NL-4018	XLR-32 series template - Pkt of 6	$1.95
NL-4020	IEC 320 chassis plug - Pkt of 6	$1.95
NL-4024	DIN chassis socket - Pkt of 6	$1.95



GAMES JOYSTICK

New low price! This unit, which is similar to our competitors units offers a huge saving. Why? Direct Import! The unit is not fitted with a connector either because a specific connector limits its use to specific computers. Fit the connector yourself and save a fortune!

DON'T PAY $49.95

Cat. XE-7032

ONLY $19.95

'TRADE PACKS OF SCREWS & NUTS etc.

By popular demand. Now you can get commonly used hardware in bulk and save a fortune!

Cat. No.	DESCRIPTION	Price
HE-0736	Rubber feet stick-on 12mm Pkt. 100	$9.60
HE-0738	Rubber feet stick-on 20mm Pkt 100	$11.50
HE-0913	TO-3 Mica insulator kit Pkt 100	$12.50
HE-0922	TO-220 Mica insulator kit Pkt 100	$9.80
HP-2742	6BA Flat washer Pkt 500	$6.95
HP-2752	4BA Flat washer Pkt 500	$6.95
HS-1521	6BAx½" Cheesehead screw Pkt 500	$7.50
HS-1522	4BAx¼" Cheesehead screw Pkt 500	$$5.95
HS-1527	4BAx½" Cheesehead screw Pkt 500	$6.95
HP-2712	6BA Hex nut brass Pkt 500	$12.50
HP-2722	4BA Hex nut brass Pkt 500	$12.50
HS-1607	No.4x¼" Self tappers Pkt 500	$4.50
HS-1609	No.4x½" Self tapper Pkt 500	$5.50

TECHNICIANS LIGHT PROBE

This N.Z. made unit enables you to place a spot of bright light in the most awkward places. Ideal for servicemen or kit assemblers. A flashlight or lamp always seems to cast a shadow where you need to see!! The exclusive design allows you to "poke light" around corners!! The unit is solidly made (Aluminium) and takes two penlight cells. A two function switch (lock-on and press-on) is also a feature.
Cat. TH-1838

ONLY $12.95

WILDCARDS II

This book is the sequel to Wildcards Vol.1. It contains much, much more information and a memory map of 7 pages. If you liked the first volume you're going to love the second even more.

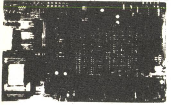
Cat. XE-8016 ....$16.00

ETI644A
See ETI Jan '83!!

DIRECT CONNECT MODEM

Ref: ETI October 1982

NEW MODEL



Two models (i) Short form which contains ALL PCB components as specified by ETI (BEWARE!!). The genuine ETI PCB with plated-thru holes, solder mask and component overlay is supplied. We also supply at NO EXTRA CHARGE a full set of quality IC sockets. A must with plated-thru PCB - remember this when making comparisons.
ii) Full kit. Includes : all of the above plus 12V plug-pack, case, switch and LED bezel and Cannon DB-25 RS-232 connector. Makes a complete stand-alone modem. ● Capable of a range of Answer/Originate operating modes ● Selectable Baud rate ● Software controlled ● Uses new patented technique ● More eliable and faster than most acoustic modems.
Arlec transformer as used in this project only $22.00

SHORTFORM KIT Cat. KE-4600	COMPLETE KIT Cat. KE-4601
ONLY $169	**ONLY $199**

LESS FEBRUARY SPECIAL DISCOUNT OF 10%

DIGITAL DELAY LINE KIT

he Digital Delay Line is designed to produce a huge variety of lectronic effects. It works very well but the amazing thing is the low, ow price! The effects depend on the time delay selected and some of hose included are: Phasing, Flanging, Chorous, ADT (Automatic Double Tracking), Echo, and Vibrato. The delay time can be varied from .32ms to 1.6 seconds! Because the signal is stored in digital form here is, unlike analog systems, no degeneration of the signal with time nd unlimited repetition is provided by use of the freeze control.
ll the controls mount directly upon PCB's to eliminate wiring and to urther simplify construction the main board is 'plated-thru' i.e. there are o wire links or link-thru pins. The whole of the memory whether for the asic 400ms machine or the fully expanded 1.6 second model all fits n the main board. The cabinet which is free standing but also suitable or 19" rack mounting, is fully finished to a very high standard. The anel is deep blue whilst the cover is sprayed with a durable black namel. The kit is available for only $449 - compare with inferior units hat can cost over $2,000!!
at. KJ-6621

COMPLETE 400MS VERSION ONLY

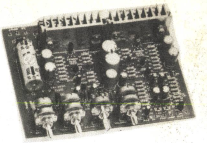
$449

30W « 30W Stereo pre-amp STEREO AMPLIFIER

- Fully built and tested
- Separate bass, treble, balance and volume controls
- Less than 0.1% distortion
- Mic, phono and aux inputs (line)
- Power supply components on board

Back at last! No hassle amplifiers. Just connect a transformer, speakers, a signal and you're away!

ONLY $34.95



SYNTOM

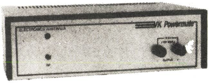
Original design from the U.K. magazine "Electronics and Music Maker" April 1981. Self-contained unit produces a variety of fixed and falling pitch effects. Trigger by tapping the unit itself or by striking the drum to which the unit is attached. The Jaycar "SYNTOM" comes complete with high quality pre-drilled moulded all ABS box 152 x 80 x 47mm with professional silk-screened front panel.
FEATURES: Decay from less than 0.1 second to several seconds, pitch control, sweep control and volume on/off.
Cat. KJ-6502

ONLY $36.50

INFRA RED DIMMER KIT

$25.95

Ref: EA January 1984
Now you can dim or turn off the lights from the comfort of your armchair!
Short form kit contains all parts for I.R. kit. Note this must be used with a Jaycar KA-1509 Touch Sensitive Dimmer ($19.95)
Cat. KA-1530



VK POWERMATE NEW MODEL

ONLY $89.95

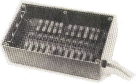
Ref: EA December 1982
Get up to 13.8V @ 10 amps to run those mobile rigs at home! The Jaycar kit is complete.

IONISER KITS

COMPLETE KIT

- High efficiency emitter head - Fits completely inside a high quality ABS box (NOT a metal lid) - Only 2-core mains flex protrudes from the box - You can pay over $80 for a built-up inferior unit!
Cat. KJ-6511

ONLY $45



SHORTFORM KIT

- runs directly from 240V mains
- low power consumption
- produces high intensity electric field
- output around 7.5kV
- will not necessarily produce ozone in standard form
- ideal for those who wish to 'try' an ioniser at an economical price.

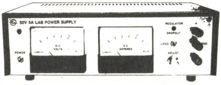
ONLY $24.50

Cat. KJ-6510

50V/5A LABORATORY POWER SUPPLY

Ref: EA May/June 1983
Cat. KE-1520

$149



CENTRONICS PLUG 36 WAY

Cat. PP-2420

$14.95

Jaycar Incorporating **ELECTRONIC AGENCIES**

SYDNEY SHOWROOMS
117 YORK STREET – PHONE: (02) 264 6688 and (02) 267 1614
TELEX: 72293
CARLINGFORD
Cnr. CARLINGFORD & PENNANT HILLS ROAD – PHONE: (02) 872 4444
CONCORD
115 – 117 PARRAMATTA ROAD – PHONE: (02) 745 3077
HURSTVILLE 121 FOREST ROAD – PHONE: (02) 570 7000

NUMBER 1 FOR KITS

POST AND PACKING CHARGES

$5 – $9.99 ($1.50)	$10 – $24.99 ($3.20)
$25 – $49.99 ($4.50)	$50 – $99.99 ($6.50)
$100 – $198 ($8.00)	Over $199 ($10)

"Free INSURANCE for Road & Registered Post over $200"
All heavy or bulky items (over 20kg.) sent Comet Road Freight $12.00 anywhere in Australia.
SHOP HOURS CARLINGFORD, CONCORD & HURSTVILLE
Mon – Fri 9am – 5.30pm: Sat – 9am – 12pm: Thurs night 8.30pm
SHOP HOURS SYDNEY
Mon – Fri 8.30am – 5,30pm. Sat – 8.30am – 12pm: Thurs night 8.30pm
MAIL ORDERS AND CORRESPONDENCE: P.O. Box 185, Concord, 2137

Mail Order By BANKCARD Via Your Phone

CHECK OUR CONCORD STORE FOR SATURDAY AFTERNOON TRADING IN FEBRUARY

ROBOTS — OUR NEXT STEP?

AUSTRALIA'S long-term employment prospects in the manufacturing industry will benefit by the introduction of robotic systems says Dr Jim Fox, a senior consultant with PA Technology.

Dr Fox said the large-scale introduction of robots could well mean a small rise in unemployment in the short term. He said, however, over the long term, robots would mean a saving of jobs because Australian manufacturing would be more competitive.

Without such an improvement in competitiveness, the rate of job loss in the manufacturing sector would increase over the next few years, he said.

His statement coincides with the distribution in mid-December last year of a top level New South Wales Government report on robotics. The report, "Opportunities For Robots in Industrial Processes," is the most extensive such report ever commissioned by an Australian state government. Dr Fox said it could lead to a rejuvenation of some sectors of the Australian manufacturing industry.

The report was prepared for the NSW Government Department of Industrial Development and Decentralisation by PA Technology and PA Management Consultants.

PA Technology, a core division of the international management and technology consulting group, PA is one of Australia's foremost independent suppliers of industrial research and development services.

Dr Fox said the robotics report analysed material ranging from the cost effectiveness of using robots through to opportunities for their local manufacture.

He said the distribution of the report by the NSW Government to approved applicants comes at a time "when the Australian manufacturing industry is finding it increasingly difficult to compete on the international market.

"It is imperative for more local companies to embrace robotics technology where applicable so as to keep pace with manufacturing developments in North America, Europe and Asia.

"The report will play an important role in helping local manufacturers determine whether a robotics system could be integrated into their production line and if so, what type".

Dr Fox said more Australian companies had to determine what areas of technology they should invest in, assess the present and likely competitive factors and then plan an appropriate marketing strategy.

One of the most significant findings of the report is that despite strong competition from foreign companies, there is an opportunity for the development of robotics technology in Australia.

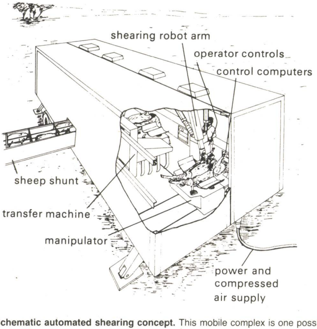
"As the Australian market is very small in world terms it is essential to consider the export potential of any such developments." Dr Fox said any Australian robotics manufacturer would have to concentrate on producing a 'next generation robot'. He cited examples such as a sheep-shearing robot or a de-boning robot for use in abattoirs.

The report lists six Australian industries where automation and robots should be seriously considered: Clothing and footwear; Heavy fabrications, including steel and concrete framed buildings, pipelaying and road making; Educational and consumer robots; Abbatoirs and the meat industry; Agriculture, fruit picking, forestry; Mining-related tasks.

The report states: "In all industries there are problems associated with the introduction of robots. However, the development in control and sensor technology currently occurring provide an opportunity for those more difficult applications to be seriously considered."

The report is believed to provide the only complete lists of Australian suppliers of industrial robots.

Further information is obtainable from Dr Jim Fox, Senior Consultant, **PA Technology, 35 Winterton Road, Clayton, Vic 3168. (03)543-4333.**



Schematic automated shearing concept. This mobile complex is one possible method for using automated shearing technology for commercial wool harvesting.

STC ENTERS SATELLITE TECHNOLOG

Precisely on contract schedule, STC has completed th
first stage of its entry into satellite technology with the delivery
to Hughes Aircraft Company i
the US of an intricate and delicate wiring system for incorpo
ration into AUSSAT — Aus
tralia's domestic communica
tions satellite.

The systems were assemble
at STC's Liverpool Plant in
'space age' factory built t
manufacture submarine re
peater units for the transoceani
cables. These, together wit
satellites, will form Australia'
future communications link
with the outside world.

"It is no coincidence," sai
Tony Cobden, STC's Manage
in charge of defence and offs
projects, "that Australia's fir
contributions to both these com
peting technologies are bein
undertaken in the same fa
tory."

STC was awarded contracts t
build the wiring systems for tw
AUSSAT satellites as part
Hughes' programme to meet i
offset commitments to the Au
tralian Government.

Mr Cobden said that, as a r
sult of this offset contract, Au
tralia would benefit from th
technology transfer and i
creased job opportunities.

AMTEX MOVES

Amtex Electronics, which d
scribes itself as a leadi
company in the solar electrici
field, is relocating its head offi
to Fairfield in Sydney's weste
suburbs, effective from th
month.

Formerly based in Cha
wood, the solar company whi
is a division of the national ele
trical wholesaling group Telc
Australia, will expand in
larger offices within the Telc
operation in Lisbon Street, Fa
field.

Both Telcon and Amtex co
under the umbrella of the Me
Manufacturers group of comp
nies. Amtex solar systems a
distributed through Telc
agents around Australia as w
as independent outlets.

TWO-CHANNEL TV SOUND APPROVED

The Minister for Communications, Mr Michael Duffy, announced in December that he had approved the European dual sub-carrier system as the Australian standard for dual-sound television broadcasts in this country.

Mr Duffy said: "As a result of this decision, Australian broadcasters who wish to transmit dual-sound broadcasts are now in a position to provide this enhanced service."

It also cleared the way for production of assembly of dual-sound television receivers to begin in Australia.

Mr Duffy said ordinary household television receivers would not be able to pick up the dual sound transmissions and new receivers would be required. It was considered that they could prove an attractive proposition, particularly for people interested in upgrading their existing sets.

"Dual-sound television is really another example of the general advance in communications techniques and reflects the wide range of choice being offered to consumers today," Mr Duffy said.

Dual-sound television will enable programmes to be broadcast in stereophonic sound. The second sound channel could also be used for transmitting programmes in an alternative language to that on the video version, or for providing spoken data.

The Minister said technical standards for dual-sound television transmissions had been established by the Department of Communications. Broadcasters wanting to introduce the new service would be required to obtain the Department's authorisation to modify technical equipment. These modifications would be required to meet the new technical standards.

Mr Duffy said that the Government had not yet considered whether the ABC and Special Broadcasting Service networks would move to the new system.

Mr Duffy said his approval of the European system followed laboratory tests by his Department and on-air tests conducted by Channels 7 and 9 in Sydney and Melbourne. Results were circulated to the broadcasting industry for comment before the new system was adopted.

SHUTTLE TO HOUSTON VIA HAM RADIO

Using 144 MHz equipment, a group of Canberra radio amateurs, under the callsign VK10RR, were able to talk to Dr Owen Garriott, a mission specialist aboard the STS-9 Shuttle which flew in December, and patch him through to the Johnston Space Centre in Houston, Texas USA.

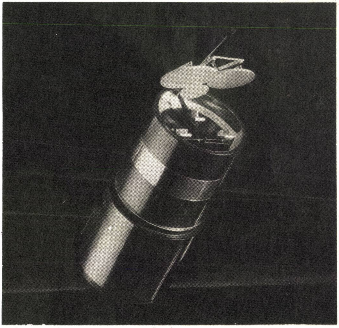
Using a special phone-patch hookup, Dr Garriott (a ham himself) was able to speak with mission control in Houston via the amateur radio link, proving that amateur radio can provide a valuable backup communications system for manned space flights. (See feature story in next month's ETI).

NOTES & ERRATA

Project 166, Part 4, October 1983: The following errors crept into the parts list; C17 should be deleted, C18 — 22p ceramic, C19 — 470p ceramic, C20 — 4n7 greencap, C21 — 47n greencap, C22 — 470n greencap, C23 — 4µ7/16 V RBLL, C24 — 47µ/16 V RBLL. A C24 shown on the circuit as 100n was not put on the pc board. It may be soldered on the copper side between pins 1 and 14 of IC4. There are two R40s on the overlay. The one next to R54 is actually R58. Some relays may not match the board and it will be necessary to drill extra holes and wire them in with links.

Project 175, Part 2, October 1983: Q1 and Q2, shown in the parts list, do not exist.

Project 1517, September 1983: There are two errors in the wiring diagram of the Video Distribution Amp. On page 148, the two yellow wires from the 2851 transformer are shown going to the top and bottom tags of the tagstrip — this is incorrect. They should both be moved one tag toward the centre of the tagstrip.



▲

SATELLITE PACKAGE

The government has decided to give all suppliers of commercial television and radio programs equal opportunities to distribute their programs via the domestic satellites to commercial stations throughout Australia.

The Minister for Communications, Mr Michael Duffy, said: "Using Satellite Program Services (SPS), regional television and radio stations will have a wider choice of program sources, including programs taken in real-time from metropolitan stations."

Mr Duffy said that the government's decision had been taken in the context of ministerial guidelines he would be giving Aussat regarding broadcasting uses of the satellite system.

"The guidelines will effectively prevent commercial direct broadcasting from the satellites, but will otherwise simply provide a framework within which interested parties can negotiate direct with Aussat," the minister said.;

Both the 30 W and the 12 W transponders will be available for supply of program services to broadcasters, as well as for other uses, but neither will be available for commercial direct broadcasting.

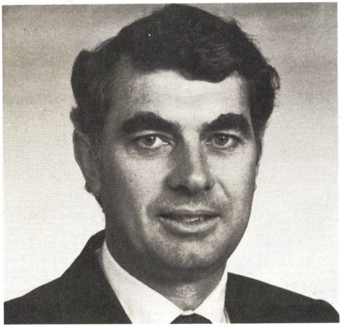
RESISTOR STANDARDS

The Standards Association of Australia has published a standard in the series on fixed resistors for use in electronics equipment.

AS 1352.2 was prepared as a Sectional Specification for use in the qualification of low-power, non-wirewound resistors according to the requirements of the International Quality Assessment System for Electronic Components (IECQ) of which Australia is a participating member.

The purpose of the standard is to establish ratings and characteristics for such resistors, to select appropriate methods of test (currently given in AS 1352.1 which is also under revision) and to give general performance requirements for this type of resistor.

The standard applies only to resistors with a dissipation of 4 W or less for use in electronics equipment. Copies of AS 1352.2 can be purchased from any SAA office at a cost of $9.20 plus $1.50 postage and handling.



TEKTRONIX EXPANDS

Tektronix has appointed Mr Philip Chaney as the new Australian managing director — part of a plan to expand the company's services and products here. He was formerly its sales manager.

Following his appointment, Mr Chaney forecast that Tektronix could increase it's size by up to a third in Australia. He also said that he expected further growth in the graphics area in particular, as more Australian companies turn to high resolution graphics and colour copiers to aid their design and reporting procedures.

One of the changes likely to occur under it's new managing director, is a new emphasis on marketing. Recent Tektronix activities, such as a 'road show' operation which recently toured Australia with a new range of technical equipment, were an example of good marketing in the high technology areas, said Mr Chaney.

IS FAIRCHILD RECOVERING?

Four years ago, hardly anyone in the US semiconductor industry believed that Schlumberger, which had just acquired Fairchild, was going to rescue the integrated circuit pioneer. It not only paid $425 million to acquire Fairchild in mid-1979 but also had to invest $680 million more in research and engineering, and in plant and equipment.

Fairchild is about to suffer it's fourth consecutive loss, but there are faint stirrings of hope at Schlumberger that the company has hit rock bottom and is now on the rise. According to Fairchild's president, Thomas C. Roberts, they now have a stable and capable management team, he has shed inefficient plants, and production has been dispersed away from California's high-cost Silicon Valley. Operating units have also been given more autonomy so that they can respond faster to market trends.

Only after Schlumberger took control did it discover how grossly Fairchild had been underinvesting in product development and in modern manufacturing facilities. Starting in the mid-1970s, Fairchild diverted IC research and development funds to a disastrous attempt to diversify into consumer electronics.

The past four years have been so wracked with changes that even Schlumberger now wonders if it has administered an overdose of medication and it has been criticised for trying to do too much all at once. Roberts really appears to many industry observers to be building a brand new company within the shell of the old, which may be a good deal easier than turning it around.

MORE TECHNICAL TRAINING FOR WOMEN

Women should plan their careers to take advantage of opportunities in technical areas.

That was the message of 'Technically Speaking' — a vocational videotape package introduced at a special screening in Canberra late last year by Mrs Ros Kelly MP, on behalf of the Federal Minister for Employment and Industrial Relations, Mr Ralph Willis.

Launching the campaign, Mrs Kelly announced the Government's intention to ensure improved participation by women in Federal employment and training programs with a view to increasing female employment in non-traditional areas of the economy.

"The videotapes show women in jobs such as metallurgical technician, draftsperson, Telecom technician and quantity surveyor. It's our hope that 'Technically Speaking' will act as catalyst for more women to enter these and similar technical occupations."

The program will be distributed through the ACT Schools Authority, TAFE Colleges, Careers Reference Centres and the CES, as well as the Women's Bureau in Canberra.

For more information on 'Technically Speaking' contact **Tina Faulk, Womens Bureau, Department of Employment and Industrial Relations, Parliament House, Canberra ACT (062)45-9518.**

ANZCAN CABLE

The Minister for Communications, Mr Michael Duffy opened the Norfolk Island Cable Station and shortly afterwards, made an inaugural telephone call to the Prime Minister, Mr Hawke in Canberra, last December.

Their discussion marked for the first time, the use of the ANZCAN cable between Australia and Norfolk Island.

The ANZCAN cable system is a $400 million submarine cable that allows Australia to communicate with New Zealand and Canada via Norfolk Island, Fiji and Hawaii. It has 1380 telephone circuits or approximately 18 times the capacity of the 20 year old Compac cable which ANZCAN will replace.

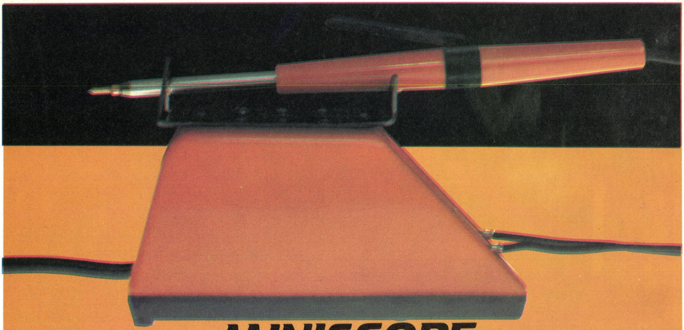
Opening the Norfolk Island Cable Station, Mr Duffy said the ANZCAN cable system represented one of the greatest ever co-operative telecommunications projects. The enterprise has brought together 22 international telecommunications organisations from 14 different countries, of which Australia's OTC was the major shareholder.

The cable will provide Norfolk Island with a new high quality telephone service and allow telex and data communications services to Australia and other countries connected to the world network.

Prior to ANZCAN, all communications to and from Norfolk Island were possible only using high frequency radio.

The ANZCAN project provides evidence of the government's committment to cable communications, said Mr Duffy.

Australia could not afford to rely on one mode of communication such as satellites and with the advent of optical fibres, the development of cable communication was fast catching up with satellite technology, he added.



MINISCOPE lets you decide the best tip temperature... while you're soldering.

ADJUSTABLE HEAT

MINISCOPE lets you adjust temperature 200°-500°c AS YOU SOLDER – because your finger is always resting on the heat switch. Here is an iron that heats in seconds, and you can vary the soldering temperature just as fast.

ADJUSTABLE WATTAGE

MINISCOPE lets you throttle back the wattage ouput to 10W or choose any thermal output up to 70W using that same finger switch replacing several fixed heat/fixed wattage conventional irons. You may seldom need Miniscope's maximum power but using an iron with too little power is the way to cook components.

FAST HEATING

20°-200°c in 5 seconds means you will reach for your MINISCOPE when you're in a hurry. 200°-400° takes another 5 seconds. This sort of power gets terminations soldered fast and that's the kindest for components.

SAFETY

The small tip mass cools fast when you put the iron down. The earthed electrostatic screen in the PSU and the floating tip and barrel lets you work on live gear.

OWNER MAINTENANCE

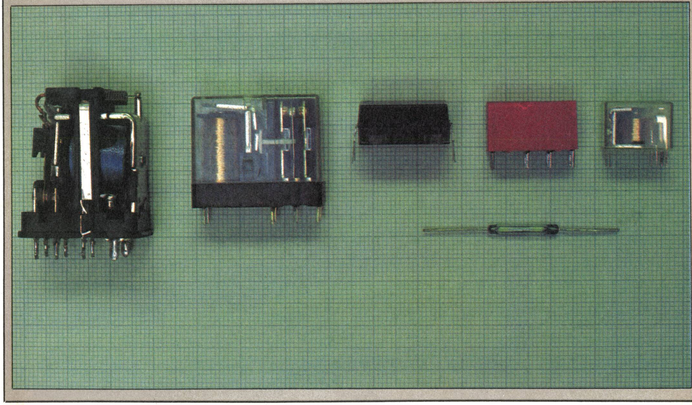
Tip and element replacement costs cents and takes only seconds using your normal tools.

FOR A FREE CATALOGUE SEND YOUR NAME AND ADDRESS TO:
FREEPOST No. 2 SCOPE LABORATORIES
P.O. BOX 63 NIDDRIE, VIC., 3042
NO STAMP REQUIRED.

BOX 63 NIDDRIE, VIC. 3042 TEL. (03) 338 1566 TLX.AA38318

SCOPE

Everything you always wante



While solid-state switches have now replaced electromechanical relays in many applications and types of service, there are still innumerable areas where the old-fashioned (?) relay still reigns supreme — and is likely to do so for many years to come. This feature covers all the theoretical and practical aspects of relay technology and includes a survey of all forms and types, from the common to the bizarre.

Collyn Rivers

UNTIL a decade ago, one of the most common electric and electronic circuit components was a partially mechanical device. That component was the electro-mechanical relay — typified by the Post Office type 3000. Tens of millions of these relays were made. They were, and indeed still are, used in applications as diverse as telephone network switching, industrial timers, burglar alarms, even computers.

The original Chain Home (CH) early warning radar systems — the vital system which helped the Battle of Britain pilots locate their enemy in World War II — each used thousands of relays in elementary computers which calculated the range of returning echoes. Those radar systems (still with relays) remained in active service until the early to mid-1960s.

Solid-state switches have long since replaced electro-magnetic relays in many applications and types of service, but there are nevertheless innumerable areas where 'old-fashioned' relays still reign supreme — and are likely to continue doing so for many years to come. Indeed the recent development of the printed circuit board mounting relay, directly drivable by TTL and CMOS ICs, and the hybrid relay (incorporating a solid-state input amplifier) has given the technology a new lease on life.

Relays (as we shall call them from here on) have a number of admirable characteristics. These include:

(1) Complete electrical isolation between input and output circuits.

(2) A huge range of resitance between switch-on/switch-off. When contacts are open circuit resistance is effectively infinite — when the contacts are closed resistance is a few milli-ohms.

(3) Many independent isolated outputs may be associated with one input.

(4) Physical ruggedness. Most relays can withstand massive short-term overloads across both actuating and switching components.

(5) Relays are largely immune to electrical, radio frequency, and other forms of radiation — even at high levels. Mechanical vibration causes problems with most relays, but vibration and shock resistant models are commercially available — and used extensively in military applications.

(6) Actuating voltages and currents are relatively uncritical. Most relays will continue to work satisfactorily with coil voltage varia-

NOTE:

World copyright of this entire relay feature belongs to Vernon, Rivers & Associates, 18 Clifton Lane, East Balmain, 2041. Telephone (02) 818-3559.

No part of the feature may be reproduced in any form or by any means without the written permission of the copyright holders.

to know about relays

but never found in one place before

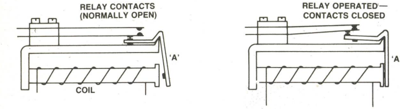
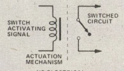
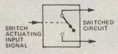


Figure 1. A relay with normally open contacts shown unoperated at left and operated at right. Note the over travel of the contact leaves. The armature is stopped by the core here.



(a) Isolated switching



(b) Non-isolated switching

Unlike electromechanical switches, most solid-state electronic switches do not provide ideal isolation between the actuating signal source and the controlled source.

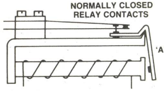


Figure 2. A relay with normally closed contacts. Note that the contact leaves are pre-loaded and the plunger on the armature operates the upper contact leaf.

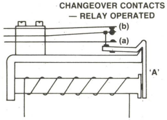


Figure 3. Relay with changeover contacts — one set of normally open contacts and one set of normally closed contacts. The armature is shown here in the operated position.

ions at least plus/minus 50% of nominal. Contacts too will generally withstand severe short-term overloads.

7) Innumerable switching configurations are possible. Single actuators may be used o switch multiple sets of contacts — any of which may be 'normally open' or 'normally closed' as required.

8) The operation of relays is largely self-evident and, for this reason alone, they are commonly used in equipment which must be maintained by non-electronically-trained staff. Fault finding too is simpler than with solid-state devices.

HOW RELAYS WORK

A relay is an electrically operated switch. The US Standard's Definition of Electric Terms defines a relay as "An electrically controlled device that opens and closes an electrical contact to effect the operation of other devices in the same or another electrical circuit".

The type of relay with which most electronics people will be familiar consists of an electromagnet, which, when energised, causes a movable armature to open or close one or more sets of contacts. The contacts in turn open or close external circuits.

There are however a vast range of relay types. The writer noted over 135 clearly definable types during the preparation of this feature. And most of those were available in an equally wide range of power ratings and contact configurations.

In the simplest of relays (one pair of contacts), one contact will usually be located semi-rigidly — it will have some degree of compliance. A second (moving) contact will be mounted on a moving arm — or on the end of a deflectable spring.

Figure 1 shows a typical arrangement — here the relay is 'normally open'. The contacts are separated until the relay winding is energised. When the winding is energised, the armature 'A' is attracted towards the winding core. The resultant movement causes the springs to deflect (according to Hooke's law) and the contacts to be pressed firmly together.

In practice, the springs deflect further than is required simply to make contact. This over-travel has several functions. It causes the spring/s to store sufficient energy to ensure a quick clean break when coil energisation ceases. The over-travel compensates for the increase in the gap between contacts as the contacts and other moving parts wear. The sliding motions entailed also cause the contacts to be largely self-cleaning. However, as will be described later in this feature, this sliding action introduces problems of its own in some applications.

Excessive spring tension is prevented by arranging for the moving armature to butt up against a stop (often the relay core) once the intended contact pressure is reached.

Figure 2 shows a 'normally closed' relay. In this example a mechanical pre-loading is applied to the springs so that the contacts are held firmly together in the 'off' position. Energising the coil causes the armature to push the contacts apart.

'Change-over' action is illustrated in Figure 3. Here a mechanical pre-load holds the moving contact against closed contact 'a' when the coil is not energized. Energising the coil causes the moving contact to be held against fixed contact 'b'.

The electromagnet

The force generated by the electromagnet must be sufficient to overcome all the restraining mechanical forces which include striction, friction, inertia, spring tension, sliding friction as contacts meet and close, and spring overtravel.

The generating force which is available may be shown as:

$$F = \frac{2\pi\,(NI)^2}{A(R_O + \frac{x}{A})^2}$$

where:

NI = ampere/turns
A = pole face area
x = distance between armature and core in unoperated state
R_O = reluctance of iron portion of magnetic circuit

It will be seen that for an electro-magnet of any given physical size the force depends upon NI^2. That is, the square of the solenoid's number of turns of wire and the current flowing through that wire.

The ampere/turns at which the relay just ▶

operates (contacts touch but springs not fully deflected) is known as the ampere/turns sensitivity. This figure has little practical value as it is independant of coil dimensions. (Having wound a coil the ampere/turns sensitivity is a measure of what you have done but gives no guidance as to how to go about it!).

A parameter of more practical value is the power required to just close the relay ($P = I^2R$). This is usually called the 'power sensitivity'. Power sensitivity depends upon the volume and proportion of available winding space occupied by the winding. As might be expected, if one thinks about it long enough, the ratio of the N^2/R is constant (N = number of turns, R = coil resistance). This ratio is known as the coil conductance and is symbolized as G_c.

Hence, $R = N^2/G_C$ and $P = I^2R = N^2I^2/G_C$ watts. Which means that the power required is inversely proportional to G_c. Coil conductance is determined by coil dimensions — as follows:

$$G_C = \frac{elh}{w\,\pi\,(d+h)}$$

where:

e = winding space factor (which = 1 except for very fine windings, then decreasing slightly thereafter).
w = winding wire resistivity.
l = length of cross section of winding.
h = depth of cross section of winding.
d = diameter of core.

The power required to close the relay varies inversely with winding length, and directly with winding depth. Which explains why energy-efficient relays (like the PO type 3000) are long and thin.

Depending upon the desired operating voltage and current, relays may be wound with many turns of fine wire, or few turns of heavy wire. The resistance may be calculated from wire tables by assessing the mean turn length. Here's a few short cuts — as long as you are using the B & S wire gauge system.

For a winding of any given dimension and density, reducing the wire size by one gauge increases winding resistance by approximately 60%. The same reduction reduces the current required (for equal ampere/turns) by 20% and the voltage by 25%.

Winding resistance tolerance will be +/- 10%. This may increase to about 15% above B & S No. 45 (depending upon wire manufacturer).

Assuming optimum dimensions, the number of turns for any given wire dimension is determined by the current density. Heat build up and dissipation must be also considered.

For most applications relays have more or less optimum physical and electrical dimensions. If a relay is made substantially smaller, here's what happens:

(1) The winding provides fewer ampere/turns of magnetic force for the same power input, but more ampere/turns are required to provide the necessary magnetic pull.

(2) The windings cannot readily dissipate the increased heat caused by the higher current density.

▶

RELAY APPLICATIONS

FIGURE A shows the simplest possible relay circuit. The winding is energised and the contacts close when SW1 is closed. A variation is shown in Figure B. Here the relay is energised when SW1 is opened.

There are many applications where the relay contacts must remain in the required position even though the initial energising signal has ceased. This may be done mechanically with a simple latch mechanism. It may also be done electrically, as shown in Figure C, by utilising one of the relay's own contacts to bypass the original make/break switch which caused the relay to be energised originally.

Electrical latching is commonly employed in security alarms. In such an application the alarm relay must remain latched on even though the actuating signal (generated for example by a microswitch on a door or window which is only momentarily opened) ceases after a second or two.

Sometimes there is a need to prevent a relay being energised via one circuit until another circuit is switched off. Figure D shows how this is done. In both instances the relay cannot be energised via SW1 until SW2 is opened.

Figure E shows how a relay and capacitor may be used to form a simple but reliable high-current oscillator or flasher.

Relays lend themselves admirably to logic operations. Figures F a/b/c illustrate the simplest forms — using switches to operate a single relay. More sophisticated logic operations can be performed using multiple windings on the same bobbin. Figure G shows one version, in which either of the two windings generates sufficient force for correct operation. Thus closing SW1 OR SW2 closes the relay.

A variation of Figure G is to have each winding alone insufficiently powerful to operate the relay. Both are required to be energised. This then is an AND circuit.

Figure H shows a differentially wound relay. Here the windings are opposed. Closing SW1 OR SW2 will cause the relay to close. Closing SW1 AND SW2 will cause it to re-open. Try that one with ICs!

Opposing windings may also be used to force a relay to open quickly. Figure I shows how this may be done to force open a self-latching relay. In this example the release winding must generate more magnetic flux than the make winding.

The configuration showsn in Figure J uses relays of differing sensitivities. Closing SW1 will energise the high sensitivity relay RL1, but not RL2. Switch SW2 shorts out the current limiting resistor R1 and brings in RL2.

Relay actuation may be speeded up dramatically by placing a low voltage tungsten globe in series — Figure K. The globe acts as a non-linear resistor — with a resistance range changing by 10:1 or 15:1 during the first 100 or so milliseconds. Both globe and relay coil should have similar working voltages. The globe must be rated such that it settles down to 90% or so of normal brilliance (for long-term reliability). The combination should be driven by a supply of approximately twice the relay's normally recommended working voltage.

Relay actuation and release may be slowed down by adding a few simple components. Figure La/b/c shows how. Triggering currents may be reduced to mere microamps by adding a simple transistor or IC amplifier — see Figures Ma/b/c. Relays such as this are also available commercially. ●

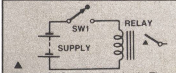


Figure A. Simple relay circuit. The relay is energised when SW1 is closed.

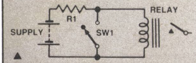


Figure B. In this configuration the relay is normally held closed and is opened when SW1 is closed.

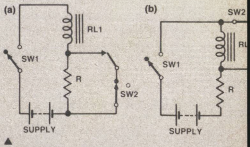


Figure D. These two configurations are commonly us safeguarding electrically powered machinery. In neither i can relay RL1 be energised, by closing SW1, unless SW2 opened.

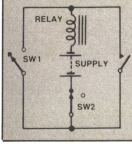


Figure C. Electromagnetic latching circuit. When SW1 is closed a second set of relay contacts close, by-passing SW1. The relay will now remain latched on until power is removed (by opening SW2).

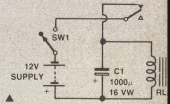


Figure E. Ultra-reliable low frequenc oscillator/flasher.

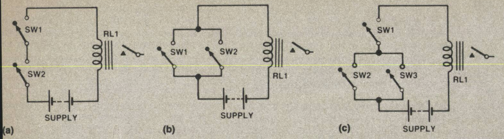
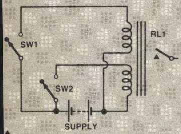


Figure F. Relay logic circuits, (a) relay closes when SW1 AND SW2 are closed, (b) relay closes when SW1 OR SW2 are closed (c) relay closes when SW1 AND SW2 OR SW3 are closed.



igure G(a). Either of the two windings can enerate sufficient force to close the relay ontacts — hence closing SW1 OR SW2 will ctuate the relay.

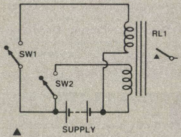


Figure G(b). In this variation neither winding alone is sufficiently powerful to operate the relay. Both are required for actuation. Thus SW1 AND SW2 must be closed.

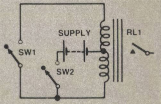
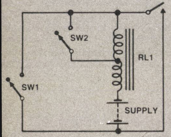


Figure H. Here the two coils are wound in opposing directions and either has enough power to close the relay. Thus closing SW1 OR SW2 will close the relay, but as the windings are in opposition closing SW1 AND SW2 will cause the relay to open again!



igure I. An opposing polarity winding is used to orce the relay open (overcoming the self-latching unction) when SW2 is closed.

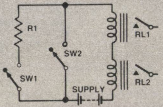


Figure J. Sequential switching. Closing SW1 will energise the sensitive relay RL1 but not the general purpose relay RL2. Switch SW2 shorts out the current limiter R1 and closes RL2.

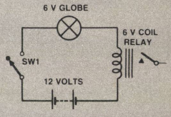
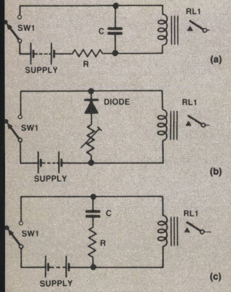


Figure K. Speeding up relay actuation — see text.



igure L. Adding a few components slows down elay operating time. (a) slow to operate, (b and c) low to release.

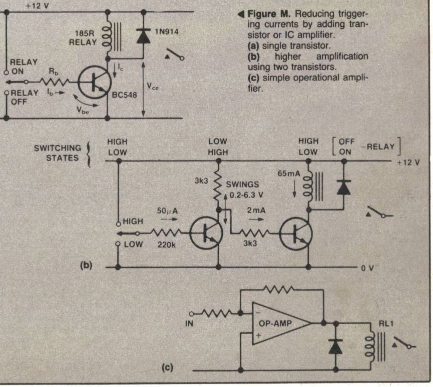


Figure M. Reducing triggering currents by adding transistor or IC amplifier.
(a) single transistor.
(b) higher amplification using two transistors.
(c) simple operational amplifier.

RELAY CHARACTERISTICS

Normally open relays are fairly predictable. Their pick-up levels can be adjusted accurately and will be maintained over long periods. Drop-out performance is less stable and cannot be predicted or sustained with any real accuracy.

There will be some bouncing as contacts come together — this may cause RF interference, and will introduce problems in counting applications (overcome by using a monostable). Relay designers attempt to minimize contact bounce by introducing a damping wiping motion — which also serves to clean the contacts.

Normally-closed relays are less predictable. They become unstable as the winding current approaches the pick-up level and may 'hunt' around the just-operated point.

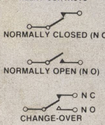
Both types of relay will exhibit erratic pick-up and drop-out behaviour if the circuits switched have large current transients. These may cause the contacts to stick.

Closing time is determined almost entirely by the time required for winding inductance to build-up the field — five to 50 milliseconds is typical of sensitive relays. The time required for the hardware to move is usually negligible by comparison (1-5 milliseconds).

Operation may be sped up by increasing operating voltage; increasing operating voltage yet further **and** adding series resistance (this reduces the circuit inductance/resistance ratio); and by reducing spring tension and contact gaps.

For **drop-out** there's normally a delay of a few milliseconds after winding current falls below the hold level. This will be decreased by as much as ten times if the coil is shunted by a diode (for instance to eliminate back-emf).

Most general purpose relays will operate reliably over a voltage range of at least 2:1. Many will tolerate even wider variations. Many aspects of performance however become less predictable and less accurately repeatable as the upper and lower limits of acceptable operating levels are approached. ●



Relay contacts. There are three fundamental relay contact arrangements: normally open (N/O), normally closed (N/C) and changeover.

(3) The armature is magnetically saturated at lower levels of force thus preventing any further increase in pull.

There is a plus however. Compact, high current-density relays are less affected by high frequency mechanical vibrations — their moving parts are smaller and lighter due to their lower moment of mechanical inertia.

We have so far discussed the power level at which a relay will operate — usually called the 'pull-in' level. The 'drop-out' level too needs to be considered.

A relay drops out at that level of power which is insufficient to carry the mechanical load required to maintain contact. This is much less than the level required for energisation and is best determined empirically, there being a number of non-electrical factors (measure it you turkey! — Ed).

RELAY CONTACTS

There's no such thing as a universal relay contact. Contacts used for switching high currents rely upon an opening and closing arc to keep them free of contaminants. Were that same contact material to be used for dry load switching, the contacts after only very few cycles, would close physically but not electrically.

Fine silver is often perceived as the best of all contact materials — certainly it has the best electrical and thermal properties of all common metals. Unfortunately silver is seriously affected by sulphidation which forms a high resistance film on the contact surfaces.

A further problem with fine silver contacts is that they tend to stick and weld together — ending the life of the relay — and sometimes that which the relay was controlling!

The problems of sticking and welding are largely overcome by combining fine silver with a small quantity of cadmium but this does nothing to reduce resistance to sulphidation.

Minor arcing, and high contact pressure can be advantageous. Arcing burns off the sulphidation, and high contact pressures (and the resultant sliding action) scrubs off the residue.

Silver and silver cadmium contacts are primarily used for switching loads of a few amps at 12 volts and above. The material has fairly high contact resistance — a potential drop of 0.2 volt is typical for normally sulphided silver and silver-cadmium contacts.

These types of materials should not be used for audio circuits. The sulphide film tends to capture dirt particles — which generate noise as signal voltages attempt to break them down. The inexorable sulphide build up renders these contacts unsuitable for intermittent operation.

Gold-flashing silver contacts reduces sulphidation to levels which are acceptable for more low-level switching — intermittent or otherwise. However, this flashing is destroyed if the contact ratings are exceeded — even for a short time. The initial resistance is lower than with most other unplated materials.

Solid gold contacts are sometimes used for low level and dry switching but are very prone to sticking if cleaned to the degree required to obtain low resistance contact.

Low level switching is probably best accomplished using gold-platinum-silver; gold-silver-nickel; or gold-diffused silver alloys — in that order of excellence and price. The maximum rating for all three alloys is about one ampere.

Palladium (from the platinum family of metals) contacts have excellent low-noise properties. They are not subject to sulphidation or oxidisation and have good longevity — about ten times that of fine silver.

On the other hand, palladium is particularly susceptible to the formation of insulating polymers if the contacts are used in very low level or dry switching circuits.

The conductivity of palladium is poor and because of this palladium contacts are limited to switching currents of less than five amps or so. Palladium contacts are used extensively in telephone-type relays.

An excellent general-purpose combination is to have one pure palladium contact and a second palladium contact coated with a 0.025 mm (0.001") 22 carat gold overlay. This combination is as equally suitable for low level and dry loads as for medium levels of power.

Tungsten is commonly used for high voltage/high current applications. It is however prone to oxidisation and for this reason (particularly in dc circuits) one tungsten contact is often paired with one palladium alloy contact.

Paralleling contacts hugely increases reliability for low and medium loads. This should not be done though for heavy loads — where single contacts tend to give better all-round peformance.

The switching action

As relay contacts close, a number of tiny areas of metal deform, elastically or plastically, until the total area is sufficient to support the contact force. (This initial deformation is one of several factors that cause contact bounce).

And, if the contacts are switching any but very light loads, the initially contacting metal areas will for a brief instant be heated to the point where the metal will boil — or be vapourised.

A microscopic weld or 'bridge' may even be formed, and with dc circuits this will break asymmetrically when the points next open (and causing a minute transfer of material from one contact to the other). With ac circuits there is usually a nett loss of material in the form of metallic vapour.

The heating effects described above also occur as contacts open.

Controlled arcing can be advantageous for some contact materials in some applications. The arcing burns off sulphur, oxides and other contaminants which build up on some contact materials.

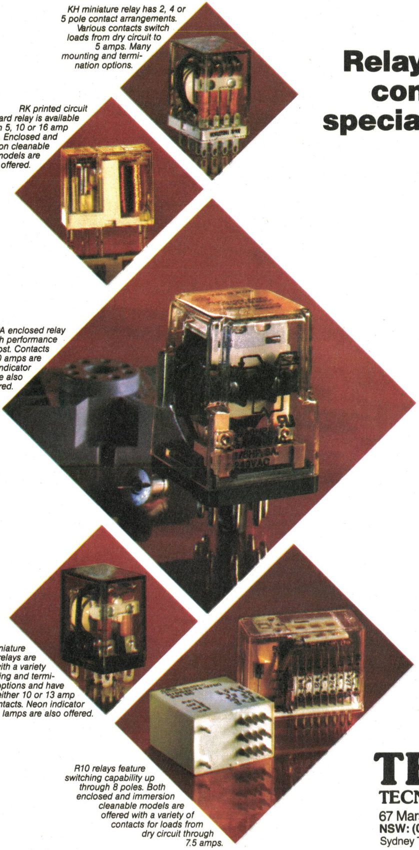
Nevertheless, whilst useful for this purpose, arcing for more than a few milliseconds is destructive and must be quenched as rapidly as possible to prevent contact material loss (to atmosphere) and contact material transfer from one contact to the other. These problems are minimised by using the arc suppression techniques described elsewhere in this supplement.

Whilst contact arcing cures some prob-

Relays that other companies call specials, P&B ship from stock.

Potter & Brumfield manufactures the broadest line of relays in North America. In many cases, specifying Potter & Brumfield can save you valuable time since you won't have to wait for a "customer special" to be tooled. Hundreds of thousands of units, everything from printed circuit board relays with dry circuit contacts to contactors with 50 amp contacts are available. And literally thousands more are tooled and can be built within standard OEM leadtimes.

Of course, all our products are of the same high quality and offer the same high performance that has made P&B the leader in the industry. And many of our products meet or exceed international standards. So why wait for "specials". Contact your nearest TECNICO office.



KH miniature relay has 2, 4 or 5 pole contact arrangements. Various contacts switch loads from dry circuit to 5 amps. Many mounting and termination options.

RK printed circuit board relay is available with 5, 10 or 16 amp contacts. Enclosed and immersion cleanable models are offered.

KRPA enclosed relay offers high performance at a low cost. Contacts for 5 or 10 amps are available. Indicator lamps are also offered.

K10 miniature power relays are available with a variety of mounting and termination options and have either 10 or 13 amp contacts. Neon indicator lamps are also offered.

R10 relays feature switching capability up through 8 poles. Both enclosed and immersion cleanable models are offered with a variety of contacts for loads from dry circuit through 7.5 amps.

P&B performance.
Nothing else comes close.

AMF
Potter&Brumfield

TECNICO
TECNICO ELECTRONICS

67 Mars Road, Lane Cove, NSW 2066
NSW: (02) 427 3444 VIC: (03) 542 3333
Sydney Telex AA 20165 (PHILIND) AUSLCTE+

AHEARN TEC 8

What's a bright young lad

ike you doing in the Army?

The simple answer of course, is that he's busy taking on all the responsibilities that come to young men bright and dedicated enough to succeed as Army Officers.

After that it gets a little tricky. Largely because once a young man completes his initial 44 weeks training at Officer Cadet School, Portsea, and graduates with a commission, his career can take a multitude of directions.

He might for example choose to enter an Infantry Battalion and become a Platoon Commander in charge of 30 men. In which case he'll obviously learn and be involved in different things to a man who flies a helicopter and commands a smaller crew. The same applies in areas like Armour, Artillery, Signals, Survey, Transport and Intelligence to name just a few.

There is, however, common ground on which every Officer stands. Irrespective of his rank or career choice.

All Officers are constantly involved in improving their ability to make rational decisions, bring out the best in their men and achieve professional results. They're regularly faced with new situations, new problems to solve and challenges that test them both mentally and physically. So they can ill-afford to rest on their laurels. Once you become an Officer, the learning process never stops. There's always something to do and a better way of doing it.

In short, life as an Army Officer is exhilarating, varied and very satisfying. You're given every opportunity to realize your potential as a leader, and be recognised for your achievements.

If you're aged between 18½ and 23 on the first day of the month in which the course commences (or up to 25 with a degree or diploma), have your HSC or equivalent (at a level acceptable to the Army) and would like to know more about what bright young lads do in the Army, contact your nearest Army Careers Recruiting Centre or fill in the supplied coupon.

There are two courses per year: Applications close mid-March for a July entry and early August for a January entry.

For more information post coupon to GPO Box XYZ, in your Capital city. Sydney 219 5555, Newcastle 2 5476, Wollongong 28 6492, Albury 55 2248, Lismore 21 6111, Canberra 82 2333, Melbourne 61 3731, Geelong 21 1588, Bendigo 43 8008, Ballarat 31 1240, Brisbane 226 2626, Townsville 72 4566, Adelaide 212 1455, Perth 325 6222, Hobart 34 7077, Launceston 31 1005.

Name____________________________

Address____________________________

____________________Postcode__________Phone__________

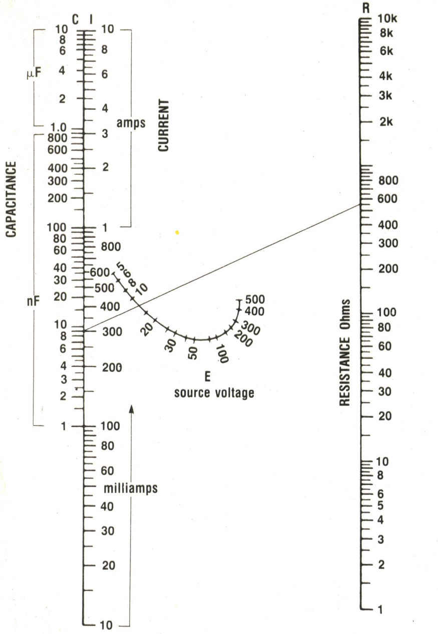
Birthdate__________Educ. Std.____________________

Army Officer. A leading profession.

All enquiries treated in confidence.

OCS12. DPS. 103

Authorised by Director-General Recruiting, Department of Defence.



R-C QUENCHING

This nomogram will give you the resistor and capacitor values for simple series R-C quenching of relay contacts for dc and ac sources switching resistive or inductive loads.

For dc applications with resistive loads the source voltage, E, is the supply voltage and the current, I, is the current flowing in the load immediately prior to opening of the relay contacts.

For ac applications with resistive loads, the source voltage, E, is the peak value of the supply and the current, I, is the peak value of the load current.

For inductive loads E is the overvoltage produced by the current interruption (can be measured with a CRO) and the current, I, has to be calculated from this voltage and the resistance of the load.

To use the nomogram, run a straightedge between the load current and the source voltage, right across to the resistance scale. The capacitance to use is adjacent to the load current, the resistance to use can be read from the scale. The example shows a 300 mA load current being switched from a 12 V source. The capacitance indicated is 9 nF (use 10 nF) and the resistance about 550 ohmss (use 560R).

Minimum resistance to be used is half Ohm, minimum capacitance is 1 nF. For E less than 70 V, R may be three times the indicated value; for E between 70 and 100 V, R may be ±50% of the indicated value; for E between 100 and 150 V, R may be ±10% of the indicated value and for E greater than 150 V, R may be ±5% of the indicated value.

$C = \frac{I^2}{10}$ μF (dc; for ac, use peak values) $R = \frac{E}{10\ I^x}$ where $x = (1 + \frac{50}{E})$

Nomogram from AMF Inc.

Figure 5.

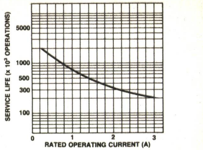
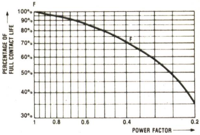
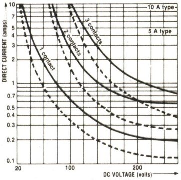


Figure 4. Graph shows how contact lire can be extended by reducing contact load for a typical power relay. This relationship does not necessarily exist for low current relays — nor necessarily for power relays used at voltages or loads insufficient to generate slight arcing.



CONTACT LIFE, INDUCTIVE LOADS

Where a relay is required to switch inductive loads, increased contact wear due to arcing reduces contact life. This reduction is shown in the diagram here. You can obtain the actual contact life compared to the full contact life (quoted for operation on resistive loads) from this diagram if you know (or can calculate) the power factor of the load.



CONTACT BREAKING CAPACITY

This diagram shows the maximum dc breaking capacity for two differently rated relays versus circuit voltage for resistive loads (solid line) and inductive loads (broken line, L/R ratio less than or equal to 40 ms). The 10 A type, rated to break 10 A at 24 V, can only break 0.5 A at 100 V where a single contact and a resistive load is involved. On an inductive load with a time constant of 40 ms it can only break 5 A at 30 V, 330 mA at 100 V. If the relay has several contact sets, connecting the contacts in series can greatly increase its braking capacity at voltages above the rated voltage, but not the maximum breaking current. With two contacts in series, the 10 A relay will break over 2.5 A at 100 V (resistive) or 1.5 A (inductive). With three contacts in series, the 10 A relay, initially rated at 24 V, will break 100 V.

lems it introduces another. It carbonises organic material that has become adsorbed or condensed on the contact surfaces.

At most relays' designed ratings the levels of voltage and current being switched are high enough to break through these carbonised deposits and contact/contact resistance will remain more or less constant throughout the relay's rated life. But these deposits can and do cause problems if a relay is used to switch (low current) loads substantially below the relay's rated level.

Softening voltage

Once the contact points have closed the voltage drop across them causes their temperature to rise. This causes the contact area to soften and increase, and any molecular thicknesses of material trapped between them is vapourised.

At this point, resistance is reduced to ractions of a milli-ohm and becomes stable egardless of further increases in current up o and beyond the relay's maximum load ating. This phenomena begins to occur at quite low temperatures — for gold it begins t about 100 °C, and for silver at about 80 °C. The respective voltage drops are bout 0.09 V and 0.08 V respectively, dropping as temperature increases.

Dry loads

Some applications involve switching circuits n which power is not made or broken by he contacts — that is, current flows and eases flowing after the points close and before they open again. Circuits such as hese are known as 'dry'.

The majority of problems with such circuits are likely to be found where very low levels of current are switched. Organic film nd particulate contamination are the primary cause of these problems.

Light loads

Light loads present slightly different prob-ems, particularly with platinum contacts. As with all relay contacts, microscopic slid-ng occurs as the contacts are pressed ogether. Here, the heat thus generated is ufficient to polymerize the organic material adsorbed or condensed on the contact urfaces. The resultant substance (a pow-er) causes high and varying levels of resis-ance. The only solution is frequent leaning.

Platinum contacts are best avoided for hese applications: gold or gold-palladium lloys are much better. They are almost otally immune from polymer formation.

ntermediate loads

witching intermediate loads is undesirable. The voltage and current is insufficient to reak down deposits and in such conditions ontact/contact resistance will increase lmost immediately. Many circuits will be ble to tolerate the resistance build up but it an cause problems in marginal applica-ons. The worst possible conditions are where the contacts must switch both high nd low levels of voltage and current.

Heavy loads

Most relay manufacturers quote contact rat-ngs at their product's designed maximum loads (or close to them). Minor derating may increase contact life, but not dramatically. Reducing the load to 20% of nominal rating typically increases contact life 10 times for power relays — see the accompanying graph, Figure 4.

It is important to note that the total current switching capacity of multiple contact *power* relays cannot be increased by paralleling contacts. The individual contact sets will not pick up and drop out simultaneously.

As contact loads and operating termperatures increase, there is an accompanying increase in the precipitation of solid carbon or carbonaceous debris on the contact surfaces. However the switching currents and voltage that cause this buildup to occur are usually also high enough to maintain relatively clean low-resistance contact in local contacting areas.

Cleanliness will also be assisted if the relay (ideally just the contact area) can be housed separately from the remaining components. This reduces exposure to volatile hydrocarbons, the liberation of which is assisted by the heat generated by high power equipment.

Gold and gold alloy contacts should be avoided for switching loads higher than 0.5 ampere unless ultra-low contact/contact resistance is essential — their erosion rate accelerates over such loads. Silver, silver alloys, silver cadmium oxide and palladium are best.

Protecting contacts

Relay contacts generally operate most satisfactorily at or close to their designed rating. But this is not always possible. In some applications current surges will occur at the worst possible time — just as the contacts initially open or close.

This will occur when switching tungsten lamps, ballasts, solenoids, relay windings(!), electric motors and capacitors. With such loads, the initial surge current may be from five to twenty times the steady state load and relays must be specified accordingly.

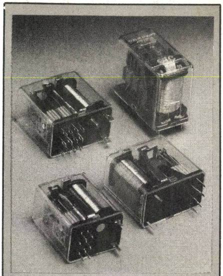
In these applications it is particularly necessary to use heavy duty contacts and/or high contact pressures, and with actuating mechanisms that inhibit contact sticking or welding.

Contact protection with *resistive* loads is relatively simple. A capacitance wired across the contact points (and as close to them as is practicable) will prevent any appreciable arc from forming as the contacts open. A low-value resistor placed in series with the capacitor prevents the capacitor being discharged rapidly through the contacts (and thus causing an arc) as the contacts reclose.

The accompanying nomograph (Figure 5) shows the optimum values of resistance and capacitance for various applications.

Inductive (dc) loads cause quite severe problems when the circuit is opened, for much of the stored energy will be dissipated as heat (in the form of arcing) unless an alternative path is provided.

The most common method of protection is to connect a diode across the inductive load — Figure 6 — with polarity arranged so that the diode blocks the current at con-



HISTORY

THE electromechanical relay was developed in the mid-1830s — for 'relaying' telegraph signals over long distances.

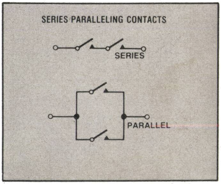
In 1837 Cooke and Wheatstone patented an electromagnetic relay for remote actuation of a signal bell (British patent No. 7710).

Edward Davy gained a patent (No. 7390), for a 'telegraphic relay' a year later. Davy opposed the granting of the Cooke and Wheatstone patent, but his objection was overthrown. Nevertheless, J. J. Fakie in his book *'A History of Electrical Telegraphy in the Year 1837'* London 1884, noted that Davy was working on electrical telegraphy as early as 1836.

In the USA, Morse was granted a patent (substantially similar to Davy's) in 1840 — US Patent No. 1647.

Davy in his patent wrote "I claim the mode of making telegraph signals or communications from one distant place to another by employment of relays of metallic circuits brought into operation by electric currents."

That's how relays came to be so-called.



Series. You can connect contacts in series to reduce the effects of arcing and to improve voltage rating; however, contact/contact resistance increases and may affect current rating.

Parallel. Connecting relay contacts in parallel should only be done to improve reliability. It will not affect current rating as the contacts will not open and close simultaneously. Thus, the rating of one contact alone will apply.

▶

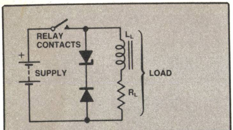


Figure 6. Protecting contacts against inductive loads (optional), Zener diode speeds up release time. ▲

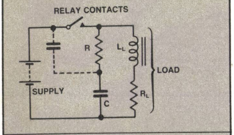


Figure 7. One method of protecting contacts against inductive loads — see main text for values. ▲

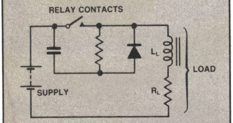


Figure 8. Alternative method of protecting contacts against inductive loads. ▲

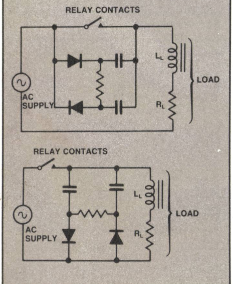


Figure 9. These two arrangements will provide almost 100% protection, even with massively inductive loads. ▲

tact closure but allows the stored energy to be conducted through it when the relay contacts open. This arrangement will usually speed up release time. An even faster release may be obtained by wiring a zener diode in series with the protection diode.

Another method is to connect a varistor across the contacts or the load. This switches from a very high resistance to a very low resistance when the back emf exceeds the varistor's clamping voltage.

Yet another alternative is to wire a resistor/capacitor network across the load or the contacts. The capacitor should be about one microfarad per ampere switched, and the resistor should either match the load (but not exceed it) or be about 0.5 to 1.00 ohm per volt switched — see Figure 7. The resistor should be a bit higher in value for small load currents (insufficient to cause a stable arc).

In critical applications the combination of resistor, capacitor and diode (Figure 8) will provide virtually 100% protection. In this arrangement the capacitor charges via the diode and discharges via the resistor. Circuit values remain as for the simpler resistor/capacitor combination but care must be taken to ensure that the capacitor and diode are of adequate working characteristics.

A further technique, used occasionally with relay coils, is to add a second but short circuited winding. The resultant damping effect attenuates the rate of change of magnetic flux in the iron core and thus the level of induced voltage.

Another nasty to watch out for is distributed line capacitance. Problems may occur if a relay is located remotely from the load to be switched. Here the line will act as a capacitor and will charge up the instant the relay contacts close. This capacitance will be seen by the contacts as an initial short circuit and contact current will flow accordingly.

Alternating current circuits

Particular care needs to be taken when switching electric motors. Starting currents are commonly 500-600% of running on-load currents. Thus a ⅓rd horsepower motor, requiring an amp or so on load, may draw over six amps during start-up.

Transformers can be especially tricky during circumstances which inevitably will occur from time to time. When power is removed, the transformer core may retain remanent magnetism. If power is re-applied at such a point on the ac waveform where voltage is of the same polarity as the remanent magnetism, the transformer core may saturate during the first half-cycle of that re-applied power. Because of this, inductance will be virtually non-existent, impedance will drop to little more than the dc resistance of the winding. The resultant in-rush current may be 1000% or more of normal and will continue until the core comes out of saturation some few cycles later.

There's *worse* yet! It happens when power is re-applied at or near the zero cross-over point. If that occurs *and* the increasing voltage is of the same polarity as the remanent magnetism, both the core *and* the air gap may saturate. And if that happens the in-rush current may be as high as **4000%.**

Surges of such magnitude generate severe electromagnetic and RF interference — which can destroy or damage other circuit components. The surges also stress the transformer windings and laminations both mechanically and thermally.

The above comments may assist those misguided folk who've used zero-voltage switches to control inductive loads. For, totally contrary to general belief, the best point at which to switch a transformer is at the peak of the sine-wave.

The above phenomena has only recently been noted. Readers who wish to pursue it further should read *Inductively Loaded SCRs Control Turn-on to Eliminate First-Cycle Surges,* Electronic Design, March 15, 1979. Also, *Controlling Transformer Inrush Currents* EDN, July 1966; and *The Great Zero Cross-over Hoax* NARM Proceedings, May 1974. (Further features on this and allied problems associated with SCRs, Triacs, and zero-voltage switching, also written by Collyn Rivers, will appear in ETI shortly).

Contact life in inductive alternating current circuits may be significantly extended by connecting a resistor/capacitor across the load for low voltage circuits (up to 48 volts), and across the contacts for voltages highe than that. The time constant shoul approximate that of the load. Note though, that for this form of protection to be effective, the impedance of the load must be substantially lower than that of th capacitor/resistor.

Better protection will be afforded by the arrangement shown in Figure 9. Diodes must be 800 volt peak inverse rating, an the capacitors (about 1 μF/amp) 400 volt dc. The resistor should be 100k/2W o thereabouts. This arrangement is als particularly effective for reducing RF hash.

As has been shown, the life of a relay i not necessarily related to the switched load. Power relay life is generally extended b derating (a reduction of 500% in load current switching will typically extend life from 10^5 to 10^6 operations). However for many other applications, derating may actuall *decrease* reliability.

Where load conditions are unusual it i best to obtain advice from the relay manufacturer. Correct maintenance helps. Her again, the manufacturers' advice should b followed. Different contact materials require quite different cleaning method and fluids. Each will absorb mono-molecular layers of volatile molecules.

As a general guide, avoid the use of lubricants, abrasive cleaners and files unles specifically advised to do so. Don't eve *think* of adjusting spring tension or gap siz unless you have exact instructions or wor for Telecom!

In critical (non-power switching) applications, reliability will be enhanced enormously (typically five or more orders o magnitude) by wiring two separate contact in parallel.

A really worthwhile tip (where circuit allow) is to arrange such that the most frequently touched parts are at earth or zer potential. This should reduce damage i your screwdriver slips!

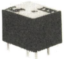
INTRODUCING RELAYS FROM ITT

LZ

5 Amp Subminiature PCB Relay

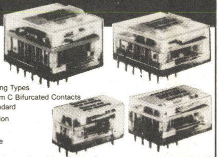
Features

- Low Cost, Highly Reliable
- Miniature Size — 0.630 × 0.827 × 0.559 Inches
- Standard And High Sensitive Types
- 1 Form C Contact
- 3 Kinds Of Contact Materials — For Low Level To 5A Switching
- Printed Circuit Terminals — Fits Grid With 0.1 Inch
- UL 478, UL 508 and CSA Recognized Relay
- UL File No. E57102 And E60816
- CSA File No. LR35577 And LR35579
- Pilot Duty Rating



PZ

1 Amp Miniature PCB Relay



Features

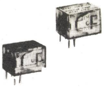
- High Reliability
- Long Life
- Low Profile
- Latching And Non-Latching Types
- 2 Form A, 2, 4 And 6 Form C Bifurcated Contacts
- More Than 70 Types Standard
- Standard DC Coil Operation
- UL File No. E57102
- Washable Types Available

MZ

1 Amp Subminiature PCB Relay

Features

- Low Cost, Highly Reliable
- Miniature Size — 0.437 × 0.591 × 0.417 Inches
- Standard And High Sensitive Types
- 1 Form C Contact
- Contact Rating — Low Level To 1A
- Printed Circuit Terminals — Fits Dual-In-Line Pitch
- Sealed Type Available

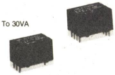


SM

0.5 Amp Subminiature PCB Relay

Features

- 1 or 2-Twin Type Break-Before-Make Contacts
- For Dry Circuit As Well As For Switchable Power Up To 30VA
- Mounts On Printed Circuit Boards
- Sealed Enclosure
- Driven By Integrated Circuits
- Immune Against Soldering And Washing Process
- Same Height As TO-5

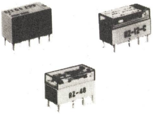


RZ

2 Amp Subminiature PCB Relay

Features

- 1 or 2 Form C Crossbar Contacts
- Bifurcated Contacts Available
- Dual-In-Line Configuration
- Sealed Package Available
- Small Size
- RF Switching Capability
- Conforms To VDE 0110
- Meets FCC 1500V Surge Spec

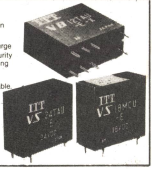


VS/VB

5, 10 Amp Miniature PCB Relay

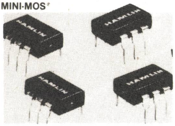
Features

- Miniature Power Relay With Big Performance In Small Package
- V Relay Withstands Large Break Down And Surge Voltages, And Conforms To International Security Standards — Meets UL508, CSA, VDE TV Rating
- Slim And Light Weight
- Varieties Of Enclosures — Flux Free or Washable.
- Designed For Heavy Duty Use
- Pilot Duty Rating Codes
  - C150 at 120V AC 22.5A
  - C300 at 240V AC 11.25A
- UL File No.: E60816
- CSA Approval LR 35577, LR 35579



AND FROM HAMLIN INC.:

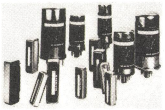
MINI-MOS®



A new line of optically isolated monolithic MOS Relays in a standard 6 Pin DIP package capable of switching AC/DC or DC only. 100% immunity to DV/DT, 100% elimination of false triggering, RFI generation and voltage offset are only a few of the features included in this near-perfect switching device. Ideal for telecommunications, data acquisition, automatic test equipment, etc.

MERCURY WETTED RELAYS

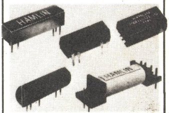
Hamlin's line of high quality mercury wetted relays are available for your most exacting requirements. Single-side stable, bi-stable in a wide range of package styles mean the best product to do the switching job you need.



SOLID STATE RELAYS

Both pure and hybrid solid state relays are available with both reed relay input and optical isolation. Zero crossing and random switching are standard plus current capabilities up to 40A. Long life and dependability all point to Hamlin solid state relays.

REED RELAYS



Quality reed switches mean quality reed relays ... from our miniature DIP to the 100 watt relays we build in quality. All our relays are "run-in" 1 million operations before final testing ... this insures quality ... other relay manufacturers charge extra for run-in; with Hamlin, it's standard at no additional cost. Contact a Hamlin engineer with your requirements.

STC-CANNON COMPONENTS PTY. LIMITED

VIC.
248 Wickham Rd.,
Moorabbin, Vic. 3189
Phone: (03) 555 9566
Telex: AA30877

N.S.W.
605 Gardeners Rd.,
Mascot, N.S.W. 2020
Phone: (02) 693 1666
Telex: AA26304

W.A.
396 Scarborough Beach Rd.,
Osborne Park, W.A. 6017
Phone: (09) 444 0211
Telex: AA93748

S.A.
66 Humphries Tce.,
Kilkenny, S.A. 5009
Phone: (08) 268 7088
Telex: AA88095

QLD.
Gabba Towers, 411 Vulture St.,
Woolloongabba, Bris. 4152
Phone: (07) 393 0377
Telex: AA43025

RELAYS

Omron relays. A little difference makes a lot of sense.

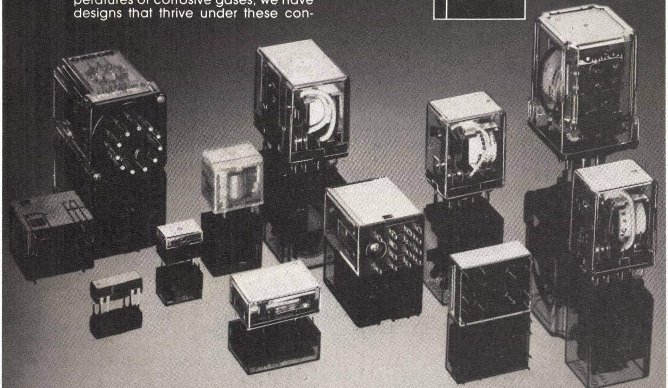
Any relay can sit there and switch current. Omron relays do more. They solve problems. For example, take our PC Board lines. Contacts can be contaminated by leakage from automatic soldering and cleaning . . . we prevent that with sealed construction. To help you save board space, we've created the world's smallest relays. We also provide upright mount relays and low-profile packages designed for close fit in racks.

In our General Purpose relay line, we offer plug-in designs and produce our own extensive line of sockets including track mount for quick snap-in mounting and removal. Many other suppliers don't. Because some applications involve high current, vibration, shock, humidity, dust, extreme temperatures or corrosive gases, we have designs that thrive under these conditions. You'll find our GP selection extremely broad.

Omron Power Relays are another good example. Our designs offer unusually large contact capacity for their size (up to 25A @ 240 VAC), plus multi-pole formats, and a choice of bracket mounts, PC board mounts, or plug-in mounting with sockets.

We want Omron relays and sockets to give you more than better performance and longer life. We also want them to help simplify your design, production and purchasing as well. It must be working . . . somebody's buying more than 70 million Omron relays a year.

OMRON



For a universe of exceptionally reliable components contact your nearest WARBURTON FRANKI OFFICE.

WF **WARBURTON FRANKI**

- ADELAIDE (08) 356-7333 ● BRISBANE (07) 52-7255 ● HOBART (002) 28-0321
- MELBOURNE (03) 699-4999 ● PERTH (09) 277-7000 ● SYDNEY (02) 648-1711
- AUCKLAND N.Z. (09) 50-4458 ● WELLINGTON N.Z. (04) 69-3016

WF811/81

RELAY TYPES

'here are well over 100 different types of elay. Most are produced with a wide choice f actuating and switching levels, contact onfigurations, ac or dc operation, and ommercial or military standards of onstruction.

Most of the material in this feature relatg to coil windings and contact materials nd characteristics applies to the relays escribed in this section — any anomalies hould be obvious.

C: ac-energised relays are similar in conruction to dc relays. however as an alterating current, by definition, passes rough a zero value each half-cycle, the agnetic field generated by an ac-energised inding will likewise have corresponding ro values each half cycle of applied alterating current.

It is necessary therefore to ensure that e relay armature remains closed as magetism falls away during every half cycle of e energising input. This may be done udely but quite effectively by making the mature so heavy that it is held in position sheer inertia!

A second and somewhat more elegant ay is to use two windings — each on a parate core — and each connected out of hase with the other.

A third method uses a heavy copper ring ting as a shorted turn. The energizing ac the main coil winding induces a current in e copper ring. This current lags the main il winding current and consequently sses through zero sometime later — thus ere is always some magnetic pull available hold the armature closed.

AC relays are generally used in nontical applications. They are unsuitable for mplex switching circuits, or for plications where timing is critical.

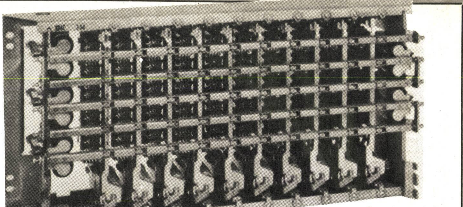
alanced Armature: these relays have armures which are pivoted at their centres of ass. they are in a state of equilibrium in spect to external static and dynamic forces d hence they are relatively immune to bration and shock loadings.

Balanced armature relays are produced a wide range of types and sizes.

rossbar switching: these are multi-contact lays and switches used for making and eaking connections across a grid or atrix. They were/are primarily used in rlier telephone exchanges (Figure 10).

urrent Sensing: nowadays generally placed by solid-state triggering circuits, ese relays operate reliably at pre-set rrent levels. A 'snap action' mechanism is nerally included to prevent contact chating or creeping. Thermal mechanisms are o used for sensing and switching current these devices respond to the heating ther than the electromagnetic effect of the ergising current.

lay-slugged: opening and closing time is delayed by up to half a second by placing a large copper collar around the winding. This delays the build-up and collapse of operating magnetic flux.



Crossbar switches: these relays make connections across a grid or matrix. They are still used for this purpose in many telephone exchanges.

The same effect is also achievable electrically by using a capacitor/resistor network with a conventional relay.

Differential: these have two or more windings which are most commonly employed in simple logic operations — AND, OR, etc. Diffential relays may also have a 'polarised' action. These will be arranged such that the direction of armature and contact movement depends upon the polarity of the coil voltage/s, either from a 'centre-off' or bistable positions.

The next two relays really do exist — to the surprise of your otherwise erudite editor! They also add a certain charm to the discipline.

Electrostatic: These are delightfully and totally basic — essentially a pair of moving capacitor plates (to which contacts are mechanically linked) and arranged so that charge forces move the plates together or apart.

Naturally, these relays only work at very high voltages, but they work equally well on ac or dc, responding to the rms value with ac. They have to be seen (preferably from a safe distance) to be totally believed.

Electrostrictive: perhaps not as rare as electrostatic devices but still not seen every second day. These utilise the movement generated across a piezo-electric crystal (or a ferro-electric material) when the material is subject to an electric field.

They have a number of unusual and endearing characteristics. Efficiency is one. Piezo-electric materials behave rather like capacitors (which in effect they are) so that energy requirements are limited to charging the devices. This may be done by one big pulse or a series of little ones. The relay then remains closed until the charge across the crystal leaks away internally (or via an external resistance). Operation is limited to dc.

High Speed: actuating speeds of less than a millisecond are obtainable primarily through the use of low mass, low moments of inertia, low eddy currents etc.

Within limits, relays may be sped up by driving the windings at their highest rated voltage or current. A very effective method, once used by the writer to speed up a 12 volt power relay, was to connect a 12 volt tungsten lamp in series with the winding, the whole then being run off 24 volts.

The lamp has very low resistance for the first 50-100 milliseconds (dropping about 1.5 volts across itself). Thus the relay is initially hit with close to 24 volts. The voltage then falls to the designed level as the globe reaches operating temperature.

Relays may also be sped up by driving the windings from a low-impedance source. Bear in mind though that excessive speed may result in equally excessive contact bounce.

Ac relays can be sped up in similar ways, but operating speed will generally have a random aspect as there is rarely any way of knowing at which point on the ac waveform the relay winding will start to become energised.

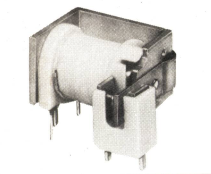
High voltage: these relays switch up to 10 000 volts at one amp or so alternating current, or about 0.2 amp dc. They may also be used to switch lower levels of voltage but in circuits working at very high voltages above earth.

Apart from the obvious requirements, such as high dielectric strength insulation, high voltage relays have large contact gaps plus rounded and polished conductors to reduce corona discharge.

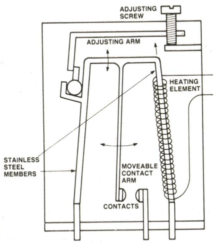
Power requirements are much higher than usual — 5 watts dc or 25 volt/amps ac being typical.

Hot wire: this type of relay uses the linear expansion of a length of wire, heated by the current passing through it, to open and close a set of contacts.

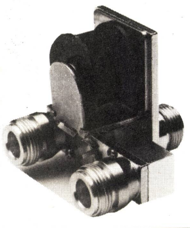
Impulse: electronic types will probably best visualise these as the mechanical equivalent of a bi-stable multivibrator! The armature and contact movement is such that they move sequentially from a first stable position to a second stable position each time the winding is energised.



High current, pc mount. This pc mount Potter & Brumfield relay (from Technico), shown about twice life size, will switch 30 A.



Linear expansion relay: current flowing through the heating element on the right hand member of the otherwise symmetrical metal yoke causes that member to expand differentially. The resultant movement is mechanically amplified causing the contact to open or close at preadjusted current levels. Changes in ambient temperature are automatically compensated for by the bi-symmetrical construction.



Coaxial relay. This RF switching relay is a coaxial changeover type that preserves the input/output impedance of 50 ohms by means of its special construction.

Linear expansion: as with the hot wire relays described above, the linear expansion relay relies upon the linear expansion of materials to provide a mechanical switching action.

A common type of linear expansion relay has two (mechanically identical) rigid metal arms around one of which is wound a heating element (Fig 11). The energizing current flows through this winding and thus heats up one of the two arms. The resultant expansion is multiplied by a simple but precise linkage and causes a set of contacts to open and close. Changes in ambient temperature affect both arms in a similar fashion — thus providing automatic compensation.

Low-level: used to switch 'dry circuits' (no power flows through the contacts until they are fully closed) or loads of less than 0.1 volt and/or less than a milliamp.

Contact surfaces are generally gold, a gold alloy, or platinum.

These relays go for ever (several billion operations is not atypical) as long as their voltage and current ratings are not exceeded.

Magnetic latching: self-latching is generally accomplished by using an additional pair of relay contacts to switch the relay directly across the power supply once the relay has been energised — even momentarily.

However, latching may also be performed magnetically — by having a permanent magnet as well as the usual soft-iron core. The (permanent) magnetic flux holds the relay in the operated state after the electromagnetic energy ceases.

The relay is reset by reversing the polarity of the electromagnetic flux, or by momentarily energising a reset coil winding, or via a mechanical mechanism.

Magnetically-latching relays are essentially bi-stable. They may be operated or reset by pulsed energy and once set will remain so securely and virtually indefinately and of course, once latched, no power is required to hold the relay in that position.

Magnetically-latching relays are highly resistant to vibration and shock loads. They are used extensively in aerospace applications.

Magnetostrictive: not often encountered — these utilise the dimensional change resulting when ferro-magnetic materials (usually nickel alloys) are subject to a magnetic field.

In one form, a coil is wound around a bundle of nickel-alloy rods. When the coil is energised, the rods become slightly longer. This movement is mechanically amplified by a lever arrangement and used to open or close a pair of the contacts.

Mechanically latching: as the name implies, these relays use a mechanical mechanism to latch them in the operated state once the electromagnetic energizing force has ceased. They are reset manually, or electrically via a separate coil and armature.

These relays are often used as machinery or circuit overload warning devices. When a load exceeds a pre-set level the relay is caused to operate and by so doing to dra human attention to the fact that some actio is required.

Mercury Plunger: these are curious lookin devices used to switch currents up to 1 amps. In the 'off' position a magnet plunger floats on top of a pool of mercur An electro-magnet, when energise attracts the magnet down into the mercur which being displaced, rises and bridges pair of contacts.

A normally-closed version has t plunger held down by a spring. The electr magnet, when energised, works in oppo tion to the spring force.

Another version allows the displac mercury to empty slowly through an orifi into a chamber filled with inert gas. The g is allowed to seep through a porous ceran plug thus introducing a controlled ti delay.

Mercury Wetted: see reed relay.

Meter relays: these were at one time us extensively to switch at precisely det mined levels of voltage, current, power whatever. They have largely been replac by solid-state electronic circuits. They a essentially conventional electri (D'Arsonval) meter movements in which moving contact, replacing the point touches a second adjustable station contact.

Like the Rolls-Royce, meter rel were/are largely a triumph of workmans over design.

Phase Sequence: many electrically dri (three-phase) machines, particularly th used in the construction industry, are c nected temporarily to various mains s plies, often by totally unskilled staff. In su applications there is a very real possibility damage or accidents being caused by motor rotating in an incorrect direction d to the phase sequence of the mains be incorrect.

Phase sequence relays check that phase sequence is correct and either in cate aberrations — or corrects th automatically.

Polarised: many of the different types relays described here may have one or m permanent magnets to provide a polaris magnetic flux which can normally flow either one or the other of two symmetri paths. The armature then moves in r ponse to the nett force produced by the t flux paths.

The permanent magnet flux increa relay efficiency, sensitivity, and operat speed. It also improves resistance to vib tion and shock.

Printed Circuit Board: these are high se tivity relays designed to be energised solid-state logic and other circuitry. Th devices deserve to be covered separately and consequently have been — elsewher this supplement.

Reed Relays: reed relays are a type of relay n which flat metal blades, often sealed vithin a glass tube, triple as armatures, prings, and conductors. Some even act as he contacts too (Figure 12).

Reed relays may be actuated by permaent magnets, or a magnetic field — in the atter case they are generally inserted within solenoid.

The devices have innumerable applictions. They are very fast, extremely eliable, and inexpensive.

There are innumerable variations includg one in which the contacts are 'wetted' by ercury drawn up the reeds by capillary ction.

Reed relays justify a feature on their wn. The only one known was written by he present author in 1971. It has recently een reprinted in ETI's associated publicaon *Circuit Techniques Vol 4* (January 984). The content is still applicable.

esonant Reed: these have been largely placed by solid-state devices. Their purose is to make or break a circuit at specific djustable) mechanical or electrical equencies.

In their electrical form they consist of a in springy reed suspended above an elecomagnet. When the winding is energised a frequency corresponding to the reed's ndamental resonance the reed is excited to a major mode of vibration at the same equency. The moving reed touches a secnd, fixed, contact once each cycle.

otary: used originally for military applicaons, these relays use armatures which tate to close the gap between one or more le faces. Their main characteristic is treme resistance to shock and vibration.

Rotary relays are produced in a wide nge of sizes and types — from microniature devices used in scientific struments to massive devices which will thstand the shock of gunfire in tanks and val vessels.

F Switching: these are commonly used for itching antennas and associated equipent. They are designed for minimum loss high frequencies, and often produced ch that their switching components have a milar characteristic impedance to the axial cables connected to them.

Auxillary contacts are often included for itching coincident non-RF circuits.

ap action: this implies a very rapid change om one stable state to a second stable ate. It is usually achieved by using part of e relay actuating mechanism to store echanical energy during initial movement d then releasing this energy to 'snap' the ntacts open or closed during the final ages of movement.

The usual method is to use some form of ver-centre' mechanism but the action may o be achieved electrically, for example scharging a capacitor through the coil nding. Magnetically polarised relays tend have snap action characteristics.

Solenoid: solenoid actuation is commonly employed where the contacts must be moved over large distances or where high contact pressures are essential.

Seolenoid relays are generally limited to non-critical on/off applications.

Both ac and dc types are available. Both are characterised by very high in-rush currents for the first few microseconds. This is caused by the distributed capacitance within the winding. With ac solenoids the change in impedance as the armature moves through the solenoid will cause current surges.

It is generally essential to use some form of protection against the extremely high voltage transients which are generated when a solenoid relay is disconnected.

Users should note that solenoid relays are commonly position-sensitive — some even rely upon gravity to move the plunger!

Stepping switches: these cover a wide range of relay-like devices are are basically switches which operate sequentially when energised by a series of pulses. Figure 13 shows one typical form.

These relays/ switches were used by the million in telephone exchanges and switchboards worldwide. They are also still commonly used in vending and other machines.

Stepping switches generally employ some form of electromagnetic actuator which causes one or more contacts to move semicircularly across further banks of contacts. In most applications the moving contact moves one step per energising pulse.

The devices commonly require 48 volts for energising, but stepping switches are also produced operating from 6 volts to 240 volts.

Telephones: typified by the ubiquitous Post Office type 3000, the term actually encompasses many different types and configurations of relays.

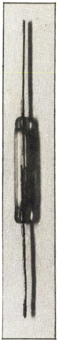
Most look something like Figure 14. They tend to have long, small diameter windings and provision for various combinations and numbers of contacts. They are difficult to assemble and adjust, but once set up they are extremely reliable.

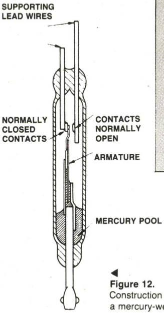
Vacuum relays: these relays have their contacts enclosed and sealed in a high vacuum. The coil winding is generally external and the contacts are actuated by magnetic transfer or mechanically via metal bellows forming part of the (generally) glass vacuum enclosure.

Vacuum sealed relays are costly but can switch very high voltages and currents for their physical size.

Voltage sensing: relatively similar to current sensing devices except that compensating networks are required to offset changes in ambient temperature. This is because a current sensing relay responds directly and only to the current flowing in the coil, and is this unaffected by ambient changes. A voltage sensing device however responds to the product of coil current and coil resistance and is thus directly affected by ambient change. ●

Reed relay. ▶
This tiny reed relay has a body just 16 mm long and about 3.5 mm diameter.





◀
Figure 12.
Construction of a mercury-wetted relay.

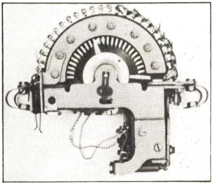
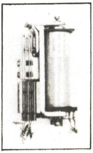
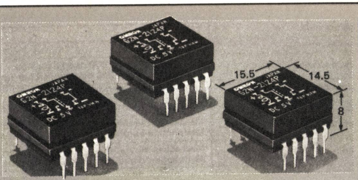


Figure 13. ▲
A stepping switch relay.



◀
Figure 14. Yes, it's a type 3000 relay!

DRIVING RELAYS FROM LOGIC CIRCUITS



Many designers specify unnecessarily complex and sometimes inherently unreliable solid-state componentry to interface their logic or other circuitry to drive medium to high current loads. Yet printed circuit board mounting relays may be driven **directly** from TTL and CMOS logic gates, or buffers or drivers. The necessary bits and pieces have been available for at least a decade!

There are a few drawbacks and very many advantages. First, the bad news.

Whilst being almost immune to false triggering from transients, static etc, electromechanical relays do themselves generate electrical noise and this may introduce unwanted problems in sensitive logic circuits. Shielded construction and arc suppression circuitry will usually provide a cure.

The second possible difficulty is that mechanical relays have a limited, (but predictable) life expectancy. However if the correct types are specified, possibly slightly derated, and given adequate contact protection, life expectancy may exceed 10^7 operations. There are few applications which even begin to approach that many cycles — in many applications the loads fail long before the relays.

On the plus side, electromechanical relays are virtually immune from false triggering — whether from load, power, static or other transients; nor do they required components to protect them against such evils.

Unlike solid-state relays, electromechanical devices need not be derated for any realistic operating temperature, nor do they require space consuming heatsinks.

There's no need for commutating dv/dt protection. Isolation between input and output is excellent — typically 100 megohms or more — with dielectric strength commonly exceeding 1000 volts at 50 Hz.

Where relays really score is in applications where the input must drive multiple outputs and especially so where the outputs are a combination of opening, closing or change-over circuits.

Here's how it's done.

TTL

Most commercially available pcb relays designed for use with TTL circuitry require energizing currents ranging from 4 mA to 25 mA (at 5 Vdc). A typical example is shown in Figure 1. Plenty of TTL ICs are more than capable of driving these relays. The 54/74 series of gates will readily handle 20 mA. The 7433 series quad switches sink 48 mA from each of the four outputs.

The 7400 series TTL buffers and drivers will readily drive most pc board relays directly — up to and including those having multiple contact 10 amp ratings. And if this is not enough there are any number of IC drivers with TTL or MOS inputs having high current output transistors fabricated into the same substrate as the logic gates. These devices will sink several hundred milliamps and can drive relays capable of switching 25 amps or more.

CMOS

The 4000 series logic gates operated at 12-15 volts will sink about 5 mA — this is sufficient to drive many sensitive pc board relays (Potter & Brumfield's Model LM for example requires 3 mA for its 5000 ohm coil and switches 1 A at 240 Vac).

As with TTL it's always possible to use a signal amplifying interface.

HYBRIDS

An increasing number of pc board mounting relays are now being produced with signal amplifiers built in. These mechanical solid-state hybrids generally use a bipolar transistor or Darlington amplifier.

A typical hybrid relay is rated at 10 amps 240 volts ac and requires less than one milliamp to drive it. ●

BIBLIOGRAPHY

Some of the sources quoted here date back thirty or more years. Despite this, however, the great majority of the information contained in these sources is still totally applicable today.

'Some Hints On Relay Operation' L. B. Stein, *QST*, June 1956.

'How To Adjust Relays For Smooth Operation' J. V. Foster, *Industrial Laboratories*, May 1959.

'How Relays Work' *Radio-Electronics*, June-December 1961.

'Relays and Switches' *Proc. IRE*. Vol 50, May 1962.

'Selection and Application of Electromagnetic Relays' (Survey of literature from 1932-1962). J. A. Csepely, *Electromechanical Components and System Design*, November 1962.

'Relays — Least Understood, Least Standardized, Most Abused' M. M. Perugini, *Electronic Equipment Engineering*, June 1963.

'Choosing Relays Or Solid-State Switching' J. A. Pfingsten, *Electronic Industries*, June 1964.

'Relays in Action,' *Electronic Design*, November 29, 1965.

'Evaluating Relays For Guided Missiles' D. D. Zimmerman, *Military Electronics*, October 1957.

'Using Those Surplus Relays' E. B. Blett, *QST*, May 1956.

'The General Purpose Relay' C. W. Derrickson and C. P. Wegenka, *Relay Conference 1961*.

'Spark Quenching at Relay Contacts Interrupting DC Circuits' A. Hamilton and R. W. Sillars, *Proc IREE*, March 1949.

'Pulse-Operated Relays for the Ham Transmitter' C. H. Ericson, *QST*, June 1953.

'A Relay Computer for General Applications' S. B. Williams, *Bell Laboratories Record*, February 1947.

'High Speed Relays in Electric Analogue Computers' R. R. Bennett and A. S. Fulton, *Electrical Engineering*, December 1951.

'Simple Decimal to Binary Converter Using Relays' D. Nairn, *Electronic Engineering (UK)*, April 1963.

'Don't Dismiss the Relay for Data Processing Systems' G. Silverman, *Electronic Design*, November 29, 1965.

'The Design of Switching Circuits' W. Keister and others, *D. Van Nostrand Co.* New York 1951.

'Relay Engineering' Struthers-Dunn, *Pitman*, N. J. 1962.

'Electric Control Systems' R. W. Jone
John Wiley & Sons, New York.

'Fundamentals of Relay Circuit Desig
A. R. Knoops, *Reinhold Publishing Co*
New York, 1965.

'Electrical Contacts Handbook' R. Holr
Springer Verlag, Berlin 1958.

'Bibliography on Electrical Contacts' pu
lished (annually) by *American Society f*
Testing and Materials 1916, Race S
Philadelphia, 3. PA.

'Proceedings of Annual Relay Conferenc
1953-1966. Microfilm only for most year
Executive Director, *National Associaton*
Relay Manufacturers, PO Box 776
Phoenix, Arizona, 85011.

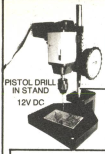
'American Standard Definitions and Term
nology for Relays' C83.16 — 1959, *Ame*
ican Standards Association, 10 E.40th S
N.Y. N.Y10016.

'Engineers' Relay Handbook' NARM
Hayden Book Co, 1966, New York.

'Practical Guide to Reed Switches' Colly
Rivers, *ETI* (Australian edition) Sept, Oc
Nov. 1971.

'Design and Build Your Own Relay'
Skeen, *Electronics Australia*, July 1983.

'Design and Build Your Own Solenoid'
Skeen, *Electronics Australia*, March 1983


DRILLS FOR PROFESSIONALS
VALUE • QUALITY • RELIABILITY
Use these products and improve efficiency

PISTOL DRILL
IN STAND
12V DC

000-62-402 Pistol Drill—$39.22 incl. S/Tax.
Single speed unit ideal for production line board assy. and repairs also modelling and prototypes—7000 RPM.
000-64-493. Drill Stand—$39.22 incl. S/Tax

2 SPEED PISTOL DRILL
12V DC

000-62-251—2 SPEED Pistol Drill $47.00 incl. S/Tax.
850 and 7000 RPM. Torque plus for the heavier jobs. SUPERB VALUE.

Power supply to suit above—000-62-608 12V. 1A. $17.40 incl. Tax.
Workshop Kit—Case, Pistol Drill, Stand, Orbital Sander, Jigsaw, Flexible Shaft and extras—$200.00 incl. S/Tax.

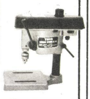
MD1
General
Purpose
6 Speed
850 to 3100
RPM

Compact Bench Drills for volume operations. Fast, reliable. Value plus for production. $198.00 incl. Vice. S/Tax extra.

240V AC

MD1H
Printed
Circuit
Board

2 Speed
8000 & 12,000
RPM

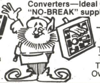

Send Self Addressed Envelope for full price and accessory list.
(Accessories include points, cutters, blades, burrs, brushes, stones, etc.)

NAME ....
ADDRESS................
....
BANKCARD NO.
OR CHEQUE ....
EXPIRY
DATE ....VALUE..........SIGNED ....

minitool
AUSTRALIA PTY. LTD.
134A AYR STREET,
DONCASTER. VIC. 3108
Tel. 850 9887

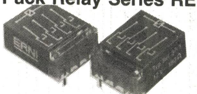
RELEASING NOW! Regulated Converters—Ideal Computer "NO-BREAK" supply—Enquiries Welcome.

Post & Pack
To $25+$3.50
To $100+$5.00
To $150+$7.00
To $400+$10.00
Over $400+$14.00



ERNI

Flat Pack Relay Series REL 37



An electromagnetic relay with two or four bifurcated contacts, it provides excellent results, both in dry load switching (gold) or high load switching of up to 4 Amp (Ag Cdo).

Test voltage 2000Vrms between contact-coil is part of the standard version.

Also available waterproof encased.

M. RUTTY & CO. PTY. LTD.
2/109-11 Hunter Street Hornsby, NSW, 2077
Phone (02) 476-4066

SOAR
ANALOG MULTIMETERS

The SX 120 and SX 220 are quality analog multimeters designed and manufactured by the Soar Corporation.

The SX 120 is a compact economical 5 function pocket model, whilst the SX 220 is a 9 function, 20 KΩ/V VOM with added features such as overload protection, continuity buzzer and a facility for temperature measurement using an optional temperature probe.

With an ABS plastic housing the high quality, core-magnet type meter movement is protected from shock and the elements as well as being free from the influence of outside magnetic fields.

See these and others in the Soar instrument range at your nearest L&H Sales Centre. With nearly 100 Australia wide, there's bound to be one near you.

L&H LAWRENCE & HANSON

L. L. BROWN & ASSOC. 981

PRICE HIKE FOR AUDIO TAPES?

CONCERN is mounting over an imminent Bill to go before Parliament shortly that would seek to impose a levy on the sale of blank audio tape.

The levy, as claimed by its proponents, would protect the copyrights of the giant record/entertainment companies against indiscriminate — and currently illegal — home taping of their material.

But a vast majority within the industry see the proposed levy as a draconian measure that would exact its greatest toll on the hapless consumer.

One of the Bill's most outspoken opponents is the Australian Audio and Video Tape Association, grouping the country's leading tape manufacturers.

AAVTA spokesman Peter Rose said: "The proposed levy would not only be a burden on consumers, many of whom do not even use their tapes to record copyright material; but it also has the runious potential of raising even more problems than it can solve."

Mr Rose pointed out that the only ones who stand to benefit from the measure are the multinational record companies, who are in fact already among the world's richest corporations.

The argument that audio tapes are being used to illegally record copyright material ignores the rights of consumers who use them for other legitimate purposes, such as in business or education, or to make use of technological developments like telephone answering machines or home computers, Mr Rose went on.

"And even in the case of the recording of copyright material, there is much evidence to suggest that the practice has in fact helped rather than hindered sales.

"In one study conducted in the US (the Yankelovich survey), it was found that two-thirds of the respondents discovered a performer through a tape from a borrowed recording; and the majority of these went out and bought the record".

Attorney-General Senator Gareth Evans, who recently outlined the Labor Government's apparently favourable view on the proposed levy, indicated that the rate would be anywhere from two to 30 Australian cents per hour of tape.

"Added to the present 35% duty and 32½% sales tax — the latter only recently increased from 20% the levy is an onerous and totally unacceptable burden to lay on the consumer," said Mr Rose.

While the Attorney-General assures at this stage that a similar levy on video tape is "unlikely", AAVTA and other opponents of the bill fear that it is an all too likely probability if ever the current measure is passed into law.

"It is no secret that major film companies — many of them also among the world's richest — have been pressing for 'protection' of their copyrights," Mr Rose said.

"Yet industry research has shown that an overwhelming 90% of blank video tapes bought are used merely for the convenience of 'time-shift' — unattended recording for viewing at a more convenient time — a practice certainly not injurious in any way to copyright owners."

The passge of the proposed bill, AAVTA believes, could set a dangerous precedent that would embolden future proponents of a video tape levy.

"Despite all the research and studies by the world's major industry organisations, no foolproof formula has yet been found for exacting a levy only from those who use tapes to record copyright material. But the answer is certainly not to overlook this important distinction and ignore the legitimate right of the majority of consumers."

Further information, can be obtained from: **Mr Peter Rose, AAVTA spokesman, 3M Australia, 950 Pacific Highway, Pymble, NSW 2073. (02) 498-9351.**

VCR GUARANTEE

AWA-Thorn has announced that as from 5 December 1983, all recently released AWA and Thorn brand video cassette recorders will be covered by a new four year guarantee.

Under this guarantee AWA-Thorn will supply parts and repair labour, at no extra cost t the owner to rectify a produc fault or failure (excluding video audio or control heads) for a period of four years.

The recently released model to which this AWA-Thorn fou year guarantee will apply are AWA-AV-11, AV-21, AV-31 Thorn-TR101, TR-201.

Any of these models bough before December 5 1983 ca also be covered by payment o $20 to AWA-Thorn.

For further information contact **AWA-Thorn Consume Products Pty Ltd, PO Box 11 Rydalmere NSW 2116. (02) 638-9022.**

CANARE CABLE

Klarion announced that Canare cable and auxillary products are again available throughout Australia.

Canare manufactures bulk and pre-wired cables, junction boxes, pigtails, multipair cables, and multipin cable assemblies.

Canare's Starquad audio cable consists of two twisted pairs plus a high density braided shield. Because each 'conductor' in the balanced cable actually consists of a twisted pair, the included area between conductors is minimised, which maximises rejection of ac hum and all forms of electro-magnetically induced noise, claims the company.

Special types are offered to suit the specific technical interface requirements of mic and line level audio, video and musical instrument circuitry. Guitar cables are available in five colours and microphone cables in 10 colours.

Canare cable reels are available for single cables or large multipair cables, with or without connector panels. Several models come with three-position brakes that regulate tension o lock the reel completely. Mos reels can be stacked and som models have roll around casters.

Canare also offers a variety o low crosstalk multipair cable for construction of custo 'snakes'. Factory wired 8-to-3 channel snakes are also available, with multipin connecto that mate either to junctio boxes or XLR pigtails.

A catalogue that answe many technical questions an lists all of the electrical an physical parameters of eac cable is also offered. Also liste are special cables for permane installation in raceways and conduit, as well as instrumentatio cable, speaker cable and heav duty pre-wired guitar cable. Extensive diagrams and plain language discussions alert studi builder/designers, soundme and engineers to the distinction between the types.

For further information, contact **Klarion Enterprises Pty Ltd PO Box 379, South Melbourn Vic 3205. (03) 61-3541.**

UNIQUE HEADSET

Sennheiser, has released a unique device for people who require occasional hearing amplification assistance.

The Conferette C2, released recently at the Hard of Hearing Congress in Germany, overcomes this problem. The device works in a similar manner to the occasional use of a pair of spectacles. The C2 folds away and is put in a little leather carrying pouch just like a spectacle carrying case.

The C2 incorporates two miniature microphones which are connected to twin amplifiers to give biphonic sound, maintaining the users' ability to perceive the direction of the sound source. Just like the home stereo, the amplifier balance may be adjusted as most people have a different hearing loss in each ear.

The C2 may also be used in conjunction with an infrared transmitter connected to a TV set giving wire-less/TV sound transmission. Since the microphones are also operating during the wire-less sound transmission, other people can still talk to the user at any time.

In order to prevent ambient noise from impairing the wireless sound transmission, the microphones only switch-on automatically in this mode when a defined sound level is reached, i.e.: when a person wearing the device is spoken to with normal speech volume from a distance of one metre.

The product will be available soon through hearing-aid specialists. It is imported by R. H. Cunningham Pty Ltd and distributed through **Shaw Sound, 160A New South Head Rd, Edgecliff, NSW 2027. (02)32-5222.**

COMPACT -DISC HEADPHONES

Sennheiser has released the Unipolar 2002 and HD230 eadphones to complement the ew wave of compact-disc layers.

The Unipolar 2002, which has frequency range of 16 Hz to 2,000 Hz, is based on an elecrostatic two-way system without switching network. It has a ontrol box to match the eadphone to any stereo power mplifier, and features a visual ver-modulation indicator. A econd headphone may be conected.

The HD230, which offers a equency response of 10 Hz to 0,000 Hz, is a two-way headhone without a frequencyividing network. The impedance of 600 ohms permits asy connection to the compactisc player.

Further information is availble from **R.H. Cunningham, 46 Roden Street, West Melourne Vic. 3003. (03) 29-9633.**

INTERFERENCE TO VCRs INVESTIGATED

Videocassette recorders (VCRs) used in households near radio transmitters could suffer from interference problems, claims a spokesman for the Department of Communications.

The spokesman said that, although not all VCRs were susceptible to the interference, the number of such complaints from residents throughout Australia had risen dramatically over the past year.

"The interference comes in the form of horizontal coloured bars across the screen when the viewer is watching a commercially pre-recorded tape.

"Unfortunately, the interference affects the 'playback' mode and therefore cannot be filtered out at the recording stage, and with many radio stations transmitting for 24 hours a day, the problem is a continuous one for viewers."

The spokesman said most radio transmitters were originally sited some distance from residential areas. With the growth of cities and towns, many householders were living in close proximity to radio transmitters and found their VCRs were susceptible to interference.

A number of complaints had recently been received from people living around the Brisbane transmitter of the ABC's Radio 4QR. The spokesman hoped other people in similar situations would now be aware of the problem and could safeguard themselves against unsuitable purchases.

BASF'S SUMMER SELLOUT

Leading audio and video tape manufacturer, BASF, was caught unawares by the runaway success of its Summer Sweepstakes promotion.

Continuing its bold strides towards market leadership, BASF found itself with no stock and still a month of the promotion to run. So, more than 30 tonnes of its entire range of audio and video cassettes had to be airfreighted from Germany to restock retailers around Australia.

BASF's manager, consumer products division, Horst Hanfeld, said the outstanding success of the Summer Sweepstakes had exceeded all expectations.

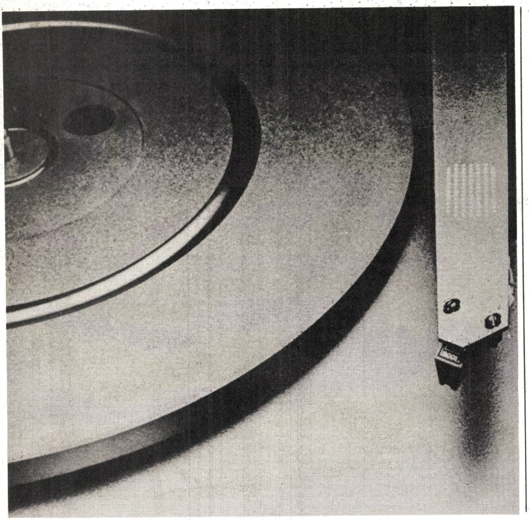
"Both audio and video sales are going like a rocket, and it is likely we will have to continue to air-freight product from Germany to keep up with demand through to the end of January," Hanfeld said.

BASF customers in all States are in the running to win an $8500 Suzuki Sierra four-wheel-drive vehicle or one of hundreds of other prizes in the Sweepstakes. He said entries were flooding into the competition.

Mr Hanfeld said the support of major radio stations around Australia had also contributed significantly to the success.

Mr Hanfeld said it appeared BASF would assume market leadership for both audio and video products early in 1984.

Things have sure "hotted up" in the tape market this summer.



PHILIPS TRENDSETS

Philips has consolidated its position as the world's leading manufacturer of colour TVs they claim by introducing the Trendset, featuring ultra-modern 'monitor-look' styling in a variety of housings including traditional silver-grey and vivi maroon.

The first Trendset on the market is the 34cm CTV CJ413 UHF/VHF portable. Weighing onl 11.8 kg, the Trendset is trul portable, with built-in retractable aerial and foldaway carr handle. Volume, brightness colour and contrast controls ar front-mounted beneath th screen. Channel selection is b soft-touch, push-button control at the top of the set.

"34cm screen size TVs represent some 40% of the Australia CTV market. Philips now ha three different models in thi size and is very well placed t cater for different consume demands and lifestyles," sai David Filsell, Philips Vide Group product manager. Th 34cm maroon Trendset is available nationally at about $499.

For further information, contact **Philips, 15 Blue Street North Sydney NSW 2060 (02)925-3333.**

NEW NAD TURNTABLE FEATURES UNIQUE ARM

Falk Electrosound has announced the release of the new NAD 5120 turntable, featuring a unique flat, flexible, phenolic tonearm.

The development of the NAD 5120 turntable involved thorough attention to suppressing or eliminating many of the vibration-induced resonances that can mar sound reproduction in conventional turntables.

The belt-driven platter and the tonearm are mounted on a floating sub-chassis with an unusually low 4 Hz suspension frequency, providing much-needed isolation from external vibrations (such as acoustic feedback) that can colour the sound.

Unlike conventional turntables that achieve smooth rotation by depending on the inertia of a heavy and costly machined metal platter (whose bell-like resonances are then only partly tamed by a rubber platter mat), the NAD 5120 employs a simple, low-flutter belt drive.

Its unique platter is a thin aluminium disk, for stiffness, combined with a soft rubber mat that is 7 mm thick in the middle and 9 mm thick at the rim where it wraps around the edge of the aluminium disk.

This platter system is said to be incapable of resonant vibration, and the smooth upper surface of the rubber mat efficiently absorbs any extraneous vibration in the vinyl record itself.

The design of the NAD 5120's tonearm overcomes a resonance problem that is inherent in the shape of conventional tonearms: a long, slim tube, especially if it is thin-walled to minimize mass, has natural flexure modes that occur at midrange frequencies. These add subtle colorations and can affect stereo imaging.

The 25 mm width of the 5120's tonearm provides ideal lateral stiffness, so it is much less prone to midrange flexure than a thin tube; and since it is constructed of non-resonant phenolic, it cannot "ring" like metal NAD claim.

In the vertical direction, however, the flat tonearm has very little stiffness. It is so flexible that the vertical flexure mode has been moved completely out of the midrange, where the ear is sensitive to any coloration, and down to the low bass — below the lowest frequencies normally encountered in recordings.

Thus, tonearm flexure has been virtually eliminated as a source of sonic coloration.

The final element in the design of the tonearm is i counterweight, which is n mounted rigidly to the tonear but rather is suspended on spring with a viscous dampe forming a compliant assemb that resonates in sympathy wit a flexure of the floppy tonearm

This forms a dynamic vibration absorber, cancelling th large infrasonic resonance that produced in all tonearms by th compliance of the stylus assembly interacting with the effectiv mass of the arm.

The Model 5120 turntable wa developed for NAD by a tea of audiophiles and enginee affiliated wqith the Tesla VUS Research Institute in Pragu Czechoslovakia.

For further information, contact **Falk Electrosound, 28 Ki Street, Rockdale NSW 221 (02)597-1111.**

Hear digital perfection.

Introducing the Sony Compact Disc Player.

When we used our long experience in digital technology to create the CDP-101 Compact Disc Player, we wanted to give you something more than the world's clearest sound.

WIRELESS REMOTE CONTROL Full-function remote control.

3-WAY MUSIC SEARCH ☐ Instant direct access to any selection with the 10-key pad on remote control unit. ☐ AMS (Automatic Music Sensor) allows access to the beginning of next or previous selection. ☐ 2-speed bi-directional search to find any desired music passage.

REPEAT FUNCTION Program to repeat the entire disc, one selection, or a specific portion of music.

3-FUNCTION DIGITAL READOUT DISPLAY ☐ Selection number. ☐ Time lapse of selection being displayed. ☐ Remaining time on the disc.

LINEAR SKATE DISC LOADING Just press the button, platter control and cueing are automatic.

Get even more perfect sound with the Sony Digital Audio Component System, "Precise Series".

It's a Sony

SONY®

AUD 0391

MCR RM4960L

"To accurately test our cartridges, we created the world's finest stereo headphones."

To test our cartridges for the improper tracing and signal-to-noise ratios that an ordinary speaker would not register, we needed highly sensitive stereo headphones.

To obtain the accuracy that our reputation demanded, we had to create our own.

The present ATH series is the second generation of Audio Technica headphones, subtly refined and further improved.

Lightweight, comfortable precision instruments, they reflect Audio Technica's unrivalled reputation for reliability and the intelligent application of advanced audio technology.

And now Australian hi-fi enthusiasts will discover Audio Technica stereo cartridges, stereo headphones, stylii, microphones, tone arms and other accessories more readily available through an expanded dealer network.

For a free Audio Technica brochure and dealer information, simply clip the coupon below.

Please send me your free Audio Technica brochure and dealer information.

Name____

Address______________________________________

______________________________Postcode__________

Post to:
Audio Technica brochure offer, c/- Rose Music Pty. Ltd.,
17-33 Market Street, South Melbourne, 3205.

audio-technica®

MCR RM4960R

MOSFET MONITORING AMPLIFIER

This new 50 W per channel amplifier provides balanced line bridging inputs via Cannon sockets to two separate and identical channels for stereo or two channel monaural use.

Both channels can be bridge connected allowing 100 watt single channel use without any additional adaptors.

For domestic use there is the matching ASC-1 high performance control unit which provides a wide selection of inputs.

For further details contact **Audiosound Laboratories, 148 Pitt Rd, North Curl Curl NSW 2099. (02)938-2068.**

TIVOLI MOVE

When Tivoli Hi-Fi move their premises they als decided to take a new directio and now specialise only in to end hi-fi equipment.

All portables, car and vide equipment have been cleare out and replaced by a wid range of up-market hi-fi compo nents. The company says tha their technically informed co sultants will be pleased to talk t you about improving, repairin or performance tuning your hi- system and after hours co sultations are welcome b appointment.

Tivoli Hi-Fi can now be foun at **155 Camberwell Rd, Hav thorn East, Vic. (03)813-3533.**

THE SUPER WALKMAN

In January last year, Sony released the Super Walkman built to the same dimensions as a standard audio cassette case. They claim that it's the worlds smallest stereo — just 109.5 mm long, 69.5 mm wide (81.3 mm with cassette inserted), 17.6 mm thick and weighing only 180 grams.

A single 1.5 V alkaline battery gives up to five hours operation. The super thin BSL motor is only 4.5 mm thick.

Dolby B noise reduction reduces tape hiss, and accidental turn-ons are eliminated by a built-in switch which prevents the unit being turned on until the headphone plug has been inserted. Either metal or CrO_2/normal tapes can be used.

Available in red, blue or silver, the Super Walkman is marketed under the WM-20 model number, retailing around $179.

Filling out the Super Walkman line in 1984 will be the WM-F20 featuring a built-in fm tuner, and the SRS series speaker-amplifier units. Built to the same dimensions as the Super Walkman, the SRS-20 and the SRS-F20 (with am/fm tuner) unfold to let the listener share the sound.

Further information can be obtained from **Sony (Australia) Pty Ltd, 33-39 Talvera Rd, North Ryde NSW 2113. (02)887-6666.**

TWO NEW SANYO VCRs

Sanyo has released two new video cassette recorders. The VTC 6500 video cassette recorder comes complete with a 12-function infra-red remote control unit that provides quick, easy control of record, playback, stop, rewind, fast forward, pause/still picture, Betascan picture search, power on/off and channel up and down buttons for the easy changing of channels.

The '6500' also boasts a 14-day, 8-event programmable timer that offers a selection of recording time, length, and schedule repetition. The built-in timer can be set to record any time up to 14 days after it has been set.

An electronic switching system has been incorporated in the VTC 6500 together with soft-touch transport controls. This feature not only makes changing functions faster and more reliable, but also reduces wear on the switch mechanism.

The VTC 6500 utilises five multi-coloured LED indicators to show how much blank tape remains. The electronic tape counter is equipped with a 4-digit display and a switchable memory function that allows any sport on the tape to be marked for easier location for programmes. When the memory switch is on and the tape is being rewound, the unit will automatically stop at the point marked by '0000'. The unit retails for around $829.

The other new model, VT 5005, is equipped with an eigh day programmable timer th can record a programme up eight days in advance. With th feature, one can also record programme at the same tin every day over the eight-d period.

Other features of the VT 5005 include a picture sear function at seven times norm speed, plus a cord remote paus control that allows the viewer edit unwanted material from l armchair. The VTC 5005's di tal timer also doubles as a 1 hour (am/pm) clock, genera regarded as more convenie than the 24-hour type.

This model sells for arou $599.

Details from **Sanyo Austra Pty Ltd, 14 Mars Rd, Lane Co NSW 2066. (02)428-5822.**

An update on the compact disc scene — three CD players reviewed

MARANTZ CD-73 • PHILIPS CD 303 • TECHNICS SL-P8

Unusual design philosophies characterise differences between these CD players and other units previously reviewed. Visual and technical differences, different demodulation processes and a different type of digital-to-analogue converter produce some interesting results.

Louis Challis

SINCE WE REVIEWED the Sony CDP-101 in ETI, February 1983, and saw our first Philips CD player, the market has responded enthusiastically to all the publicity. Most manufacturers are already selling their second series, and in some cases their third series, of CD players.

In a number of pre-release models that we have seen recently, the second or third series of CD players incorporate technical advances and improvements in manufacturng which reduce the costs and cause the irst models to be superseded. The most notable of these is undoubtedly Pioneer's irst excellent P-D1 model which was so expensively and well made that Pioneer was not able to sell them with a reasonable profit margin.

When we reviewed the first series of six CD players in ETI, September 1983, there were not many players in the shops and even less software. That situation has now changed; my local hi-fi retailer usually has a minimum of half a dozen machines to pick rom and my local record shop generally has approximately 80 discs from which I can elect. Both the players and the discs are constantly on the move.

You may have been interested in CD players and enthusiastic about the concept, however, it is only now possible to evaluate players in the shop or hear a representative selection of the discs. Some of the early discs released leave much to be desired.

MARANTZ CD-73

Manufacturer:	*Marantz, initially in Belgium, now in Japan.*
Distributor:	*Marantz (Aust) Pty Ltd, 19 Chard Rd, Brookvale NSW 2100. (02)939-1900.*

PHILIPS CD 303

Manufacturer:	*Philips, Hasselt, Belgium.*
Distributor:	*Philips Consumer Products, 1092 Centre Rd, Clayton Vic. 3168. (03)542-3333.*

TECHNICS SL-P8

Manufacturer:	*Technics, Osaka, Japan.*
Distributor:	*National Panasonic (Aust) Pty Ltd, 95 Epping Rd, Nth Ryde NSW 2113. (02)887-5333.*

Having purchased a dozen discs, I am now aware of how technically poor some of the original analogue recorded material sounds when used as a basis for producing a CD disc. I am not the only one with these views. Not only have some of my reviewer friends overseas been complaining but, more significantly, the key marketing personnel at such illustrious firms as Phonogram, Sony-CBS and EMI also share my concern.

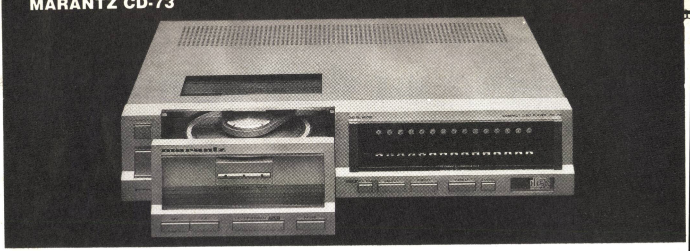
But before I discourage you, let me assure you that this situation is rapidly changing and most of the new material being produced and released now is of a much higher calibre than some of those early releases that hit the market.

In order to critically assess the three newly released CD players in this review, I acquired some representative CD discs from Deutsche Gramophone, Polydor and Phonogram. These discs have convinced me that the CD medium is not only worth the time and trouble but is also worth the money.

The three CD players being reviewed are representative of the low to medium price range of machines being released in Europe, America and Japan. They are a Marantz CD-73, a low to middle price range machine from that company; a Philips CD 303, a low to middle price range machine from Philips; the Technics SL-P8 is the first machine to be released by that company but would be considered a middle price range machine. ▶

Make and Model	Recom. Retail Price	Dimensions W x H x D mm	Weight kg	Remote Control	Disc. Rotation	Dynamic Range with Emphasis	Distortion @ 1 kH3 re 0/VU	Distortion @ −60 dB re max recorded level
MARANTZ CD-73	$899	416 x 81 x 300	8	No	Horizontal	89 dB Lin 102 dB (A)	0.0019%	−29.1 dB
PHILIPS CD-303	$899	420 x 88 x 315	8.2	Yes	Horizontal	94 dB Lin 105 dB (A)	0.0018%	−28.9 dB
TECHNICS SL-P8	$1100	430 x 88 x 325	6.1	No	Horizontal	107 dB Lin 117 dB (A)	0.0018%	−44.3 dB

MARANTZ CD-73



Marantz CD-73

The Marantz player is visually attractive featuring what I can only describe as the classical 'big and brassy' appearance that seems to be that company's design trademark. In keeping with the latest market demands, the unit features a front-loading disc system which is pushbutton operated and has a slide out drawer and hinge-up disc clamping cover.

The front of the machine is, in typical Marantz fashion, golden, satin brushed, aluminium with two large clear viewing windows on the right and left-hand sides of the front panel. On the extreme left-hand side is the reasonably small open/close button which is sensibly located at the top of the panel; below is the illuminated power on/off switch. To the right of these controls is a clear panel which has, at its base, four switches for 'reverse', 'fast-forward', 'next programme and play' and 'pause'.

Behind the clear panel are three light emitting diodes. A red LED is used to indicate that the laser is in operation, a green LED indicates the standby mode and a yellow LED indicates that the equipment is in the pause mode.

On the right-hand side of the panel is an elongated clear viewing window behind which are 15 numbered green lights to indicate the precise number of different tracks actually recorded on the disc. Immediately below these lights are 15 yellow LEDs which are individually illuminated during the programming sequence; the controls for these are positioned on the front panel immediately below.

Unlike some of the Japanese machines that we have recently reviewed and, more specifically, the Technics machine that I will describe below, this machine only provides a visual programming indication up to a maximum number of 15 sequences. If you happen to have a test disc with up to 42 tracks, as I do, you can have your work cut out in obtaining assistance from the machine to undertake an automated track selection.

The Marantz philosophy, which is undoubtedly true for most current commercial discs, is that there are unlikely to be more than 15 tracks on the disc; if there are the overflow light will operate and the player will proceed to play those tracks but will not provide user pre-selection for those tracks beyond number 15.

The controls associated with this section of the Marantz CD player are delightfully easy to use and during normal usage will be infrequently used, if ever. The latest research data from America and Japan indicates that most people using a CD player load a disc and play it from start to finish. Of course this situation may change but if you want to listen to music and not 'play with machines' all you really need are three controls; 'open/close', 'play' and occasionally 'stop'.

The 'stop/all cancel' control is self-explanatory; 'select' allows you to index the programme selection number independently of what is actually being played using the yellow LEDs in the large display above: when the 'preset button' is pressed for a given selection it memorises that track number; the 'repeat' button memorises the sequence just recorded and plays tha sequence again, however, if no sequence has been recorded, the unit replays the whole of the disc; the 'cancel' button cancels the memorised track sequence information.

The top of the player features a clea acrylic window in the steel cover throug which you can see if a disc is loaded. Thi

MEASURED PERFORMANCE OF MARANTZ CD-73 — Serial No. 100386

FREQUENCY RESPONSE

FREQUENCY	OUTPUT LEVEL dB
1.0kHz	0.0
20Hz	-0.1
40Hz	-0.1
100Hz	+0.1
200Hz	+0.1
500Hz	+0.1
1.0kHz	0.0
5.0kHz	-0.2
10.0kHz	-0.8
16.0kHz	-1.0
20.0kHz	-1.3

LINEARITY

RECORDED LEVEL dB	OUTPUT LEVEL dB
0.0	0.0
-1.0	-1.0
-3.0	-3.0
-6.0	-6.0
-10.0	-9.9
-20.0	-20.0
-60.0	-60.0
-80.0	-77.7
-90.0	-85.3

EMPHASIS

Frequency	Recorded Level	Output Level (Left)		Output Level (Right)	
1kHz	-0.37dB	-0.3	dB	-0.3	dB
5kHz	-4.53dB	-4.9	dB	-5.0	dB
16kHz	-9.04dB	-10.2	dB	-10.2	dB

CHANNEL SEPARATION

FREQUENCY	RIGHT INTO LEFT dB	LEFT INTO RIGHT dB
100Hz	112.4	100.3
1kHz	103.3	98.0
10kHz	83.7	96.7
20kHz	78.9	-95.1

DISTORTION AT MAXIMUM OUTPUT LEVEL = 0dB

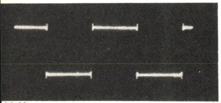
	100Hz	1kHz	10kHz	
2nd	-94.3	-95.7	-89.3	dB
3rd	-91.7	-104.6	out	dB
4th	-101.0	-102.1	of	dB
5th	-106.1	-110.8	Range	dB
T.H.D.	0.0034	0.0019	0.0034	%

AT INDICATED LEVELS FREQUENCY = 1kHz

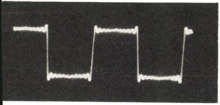
	Level = - 10dB	Level = -20dB	Level = -60dB	Level = -80 dB	
2nd	-	-	-	-	dB
3rd	-86.3	-84.1	-33.2	-16.3	dB
4th	-	-75.9	-32.5	-20.1	dB
5th	-93.2	-81.9	-36.7	-27.5	dB
T.H.D.(%)	0.005	0.019	3.5	18.7	%
T.H.D.(dB)	-86.0	- -74.4	-29.1	-14.6	dB

SIGNAL TO NOISE RATIO

Without Emphasis	88.0dB(Lin) 91.0dB(A)
With Emphasis	89dB(Lin) 102.0dB(A)



00 Hz



l kHz

over is finished in the now famous Marantz gold' and is well ventilated by neans of a large area of perforated metal at s rear.

The rear panel of the unit incorporates wo gold-plated coaxial signal sockets, two emote control sockets, a large heat sink, a use holder, voltage selector and a continenal rather than an international mains power ocket to accept a double insulated two-wire ower lead.

The objective testing of this unit was performed using the Sony test disc YEDS 7 whose performance we have previously compared directly with the Philips test disc. (See ETI, September 1983). The measured frequency response of the Marantz CD player is essentially flat to 10 kHz, is only down by 1 dB at 16 kHz and by a miniscule 1.3 dB at 20 kHz.

The linearity proved to be perfect down to −60 dB, but over the range 60 dB to 90 dB exhibited the normal problems of slight imperfections in the digital-to-analogue conversion process. By way of example, at −80 dB the measured signal was 2.3 dB high while at −90 dB the signal was a quite perceptible 4.7 dB high.

The unweighted signal-to-noise ratio was 88 dB while the A weighted signal-to-noise ratio was 91 dB(A) without emphasis. With emphasis this figure improved to 102 db(A).

The channel separation was much better than the specification at all frequencies below 5 kHz in both channels and only exhibited slightly lower performance between 5 and 20 kHz for a signal separation from right to left channel.

The measured distortion at the maximum output level is substantially better than the manufacturer's claims at all frequencies. It only starts to become significant at −60 dB where it rises to 3.5% and at −80 dB where it rises to a very measurable, but generally inaudible, 18.7%. The measured emphasis characteristics are quite acceptable and well within specification.

The square wave response test displays an unusual ripple; this is a function of the type of demodulation filter that Marantz has chosen which they selected in conjunction with the Philips research laboratories. The characteristics of this filter are different from everybody elses and result in a different measurement and audible characteristic to the other units now available.

We tried to measure the wow and flutter with a new test disc we had acquired specifically for this purpose. This test disc has an offset centre hole and we found that we could not measure the wow and flutter; this machine would accept the disc and play it when the majority of other machines refused.

Taken overall, the Marantz CD-73 provides exemplary performance over most of the range. It only shows moderately high distortion characteristics at the very bottom end of its dynamic range.

Philips CD 303

he Philips CD 303 compact disc player is ery different from the Philips CD players hat I have been used to seeing at my local ecord shop. The record shop's player is a op-loading unit which I believe is currently he cheapest machine in the Philips' range nd is probably the least expensive available n Australia at the moment.

The CD 303 has a number of significant imilarities in both appearance and perormance to the Marantz CD-73. The reaons for this are not hard to find as many of he technical components and design philosophies are common; I suspect the two nachines may have even come out of the ame factory in Belgium.

The CD 303 also features a disc pen/close' and an illuminated 'power on/ ff' switch on the left-hand side of the rushed satin, aluminium front panel. Like the Marantz machine, the disc-loading tray slides out and the overlying clear cover lifts up to facilitate the loading of your disc.

The front of the disc compartment features a 15-segment display module indicating the number of tracks on the disc. Below this are the associated rectangular LEDs required for the automatic multi-mode programmable selection facility. These work in a very similar manner to those of the Marantz machine, although the machines have many other significant visual differences in both facilities and layout of the front panel controls.

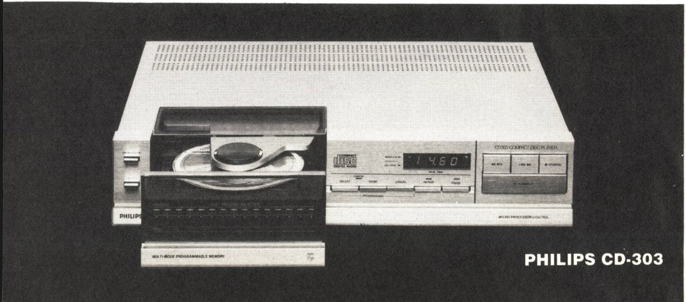
The four main controls on this machine are all grouped on the right-hand side of the panel; 'play/next' (track) is a triple width touch bar and above it are three smaller controls for 'reverse', 'fast-forward' and 'stop/clear memory'.

In the centre of the escutcheon are five controls for 'programme selection', 'storage' and 'cancelling', 'repeat' and 'pause' which are supplemented by LEDs.

Immediately above these controls is an illuminated display which provides data on both absolute (total) playing time and relative playing time (for that track) in minutes and seconds. This feature is controlled by a small switch on the side of the display which took me a while to find and was not described in the handbook.

The top of the cabinet features a strong, steel cover with a large, clear transparent area overlying the CD playing section. An area of perforated metal towards the back allows for ventilation.

The rear of the unit is even simpler than the Marantz machine featuring, much to my surprise, a permanently wired pair of signal ▶



PHILIPS CD-303

MEASURED PERFORMANCE OF PHILIPS CD 303 Serial No. 000782

FREQUENCY RESPONSE

FREQUENCY	OUTPUT LEVEL dB
1.0kHz	0.0
20Hz	-0.2
40Hz	-0.2
100Hz	0.0
200Hz	0.0
500Hz	0.0
1.0kHz	0.0
5.0kHz	-0.3
10.0kHz	-0.8
16.0kHz	-1.1
20.0kHz	-1.2

LINEARITY

RECORDED LEVEL dB	OUTPUT LEVEL dB
0.0	0.0
-1.0	-1.0
-3.0	-3.0
-6.0	-6.0
-10.0	-10.0
-20.0	-20.0
-60.0	-59.9
-80.0	-78.2
-90.0	-86.0

EMPHASIS

Frequency	Recorded Level	Output Level (Left)		Output Level (Right)	
1kHz	-0.37dB	-0.3	dB	-0.3	dB
5kHz	-4.53dB	-5.0	dB	-4.9	dB
16kHz	-9.04dB	-10.2	dB	-10.2	dB

CHANNEL SEPARATION

FREQUENCY	RIGHT INTO LEFT dB	LEFT INTO RIGHT dB
100Hz	108.2	107.5
1kHz	102.6	98.7
10kHz	-83.0	-95.3
20kHz	-78.5	91.7

DISTORTION AT MAXIMUM OUTPUT LEVEL = 0dB

	100Hz	1kHz	10kHz	
2nd	-99.2	-96.2	-92.0	dB
3rd	-90.0	-104.3	out	dB
4th	-103.6	-108.9	of	dB
5th	-105.7	-105.7	Range	dB
T.H.D.	0.0034	0.0018	0.0025	%

AT INDICATED LEVELS FREQUENCY = 1kHz

	Level = - 10dB	Level = -20dB	Level = -60dB	Level = 180 dB	
2nd	-	-	-	-	dB
3rd	-101.1	-93.6	-33.4	-17.5	dB
4th	-105.0	-	-32.7	-20.7	dB
5th	-96.2	-97.2	-35.6	-29.3	dB
T.H.D.(%)	0.0019	0.0025	3.6	16.5	%
T.H.D.(dB)	-94.4	-92.0	-28.9	-15.7	dB

SIGNAL TO NOISE RATIO

Without Emphasis	93.0dB(Lin) 104.0dB(A)
With Emphasis	94.0dB(Lin) 105.0dB(A)

leads terminated in coaxial sockets (not gold plated) and a double insulated mains lead from the other side of the panel. The unit is wired for 240 volts with no fuse visible and no facilities for changing the voltage.

The objective testing of this unit was simple and straight forward. The fequency response was essentially flat to 10 kHz, 1.1 dB down at 16 kHz and only 1.2 dB down at 20 kHz. The linearity was essentially flat to −60 dB, only 1.8 dB high at −80 dB and 4 dB high at −90 dB.

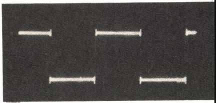
The unweighted signal-to-noise ratio is excellent; 93 dB and 104 dB(A) without emphasis and providing 1 dB better performance with emphasis. The channel separation is better than the specification at all frequencies, with the exception of the right to left channel between 5 kHz and 20 kHz where it measurably drops but is still completely adequate.

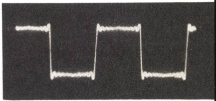
The distortion characteristics at maximum signal level are significantly better than the specification being only 0.0018% at 1 kHz and only 0.0034% at 100 kHz. These distortion figures remain essentially the same over the first 30 dB of the signal range, rising to 3.6% at −60 dB and 16.5% at −80 dB.

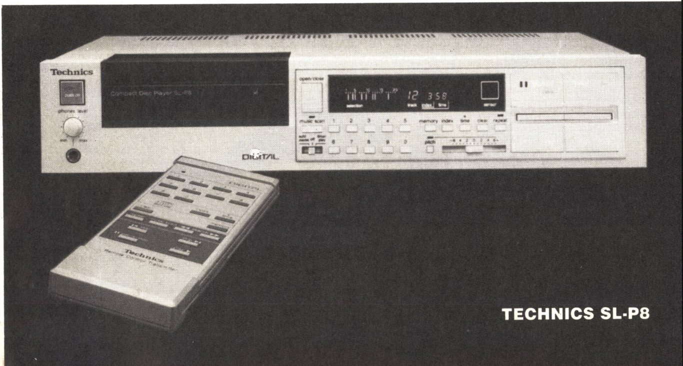
The low level distortion figures from the Marantz and Philips disc players, it should be noted, are amongst the best that we have seen and are a result of the type of digital-to-analogue converter which is associated with the particular design philsophy of these two units.

The measured emphasis characteristics are also well within the specification and the wow and flutter was just not measurable. The overall performance of the Philips CD 303 is remarkably similar to the Marantz CD-73 and I suspect that they may use similar circuitry and possibly a number of common components as well.

While the performance is excellent it is, however, not quite as esoteric as some o the other CD players that we hav reviewed.


100 Hz


1 kHz



TECHNICS SL-P8

Technics SL-P8

The Technics SL-P8 compact disc player is the first, not the eighth, model released by Technics. The first thing I noticed about this particular player, when compared with the other two players, was how much lighter it is when it is picked up.

The differences do not end there, however, as this machine has many other visual and technical differences when compared with some of the other machines that I have previously reviewed.

The front of the SL-P8 has a somewhat 'busier' appearance than the other two players. The front panel is divided into four separate areas. At the extreme left-hand side is the 'power on/off' switch and below is a volume control for the tip-ring-sleeve socket provided for a pair of 8 ohm headphones.

Immediately to the right of this is the slide-out tray for loading the compact disc. This operates in a very similar manner to that of the Sony units but looks very different. The tray opens by pressing the 'open/close' switch but will also close by pressing the 'play' button.

The main controls are located at the right-hand side of the panel and consist of a 'pause' and a 'play', both of which are self-illuminated. Immediately below these controls are two long, thin, touch buttons labelled 'search' which provide a form of fast-forward and reverse, rather than skipping from track to track. When these controls are utilised the rate of forward or reverse tracking increases with time to provide a variable rate of fast-forward or reverse.

The lowest two controls are a foward and reverse "skip" button which allow you to move backwards and forwards by one complete track.

At the top centre of the panel is an illuminated, fluorescent display which provides a bar-graph type of indication as to how many tracks are on the disc up to a maximum of 20. This also provides an indication as to which track is selected or is playing (by means of a flashing bar), the track number and either the index time data relating to the track being played or the total playing time available or that has elapsed.

The secondary controls located below include the 'music scan' button which allows you to listen sequentially to the first 10 seconds of each track on the disc, and 10 numeral key buttons by which you can enter the track selection number up to 34 and the associated sequence in which you want those tracks.

Other controls include the 'memory' activate button, the 'index' button to select index data, the 'time' button that tells you the remaining time on the disc, the 'clear' button which clears the memory when you make a mistake and the 'repeat' button which allows you to repeat either a selected sequence or replay the whole disc.

Adjacent to the digital display is a sensor window which receives the infrared signal from a remote control unit which was not supplied with the unit we received. At the bottom left-hand corner of the control panel is a three-position switch for 'auto-pause' which causes the disc player to pause automatically at the commencement of each track, even when no pause is incorporated on the disc. One of the imported discs that we have has no pauses between tracks and consequently this facility now has more meaning.

An associated control setting includes 'time play' which allows the unit to be controlled by an external programmable timer. The most unusual control is the pitch control, a new feature that none of the previous reviewed CD players incorporated. This provides a +5.3% to −3.5% speed range adjustment, enabling you to set the speed of your music and also the pitch of that music.

The top of the cabinet, like those of the other two units, is strongly made of steel and also features a large area of perforated metal to assist ventilation at the rear. The rear panel provides a pair of coaxial sockets, a synchronising timing socket and an external equipment control socket so that the unit may be inter-connected with existing or future components in a music centre. The unit is double insulated and provides two switch-voltage setting positions.

The frequency response of this unit is very similar to the other two units, being almost flat to 5 kHz, dropping to 0.7 dB at 10 kHz and being only 1 dB down at 16 kHz and 20 kHz. The digital-to-analogue conversion linearity of this particular CD player is extremely good exhibiting an effectively flat linearity to −60 dB, only 0.2 dB low at −80 dB and 1.3 dB high at −90 dB. *These are the best linearity figures we have yet seen from any CD player.*

The signal-to-noise performance of this CD player is also really excellent with an unweighted signal-to-noise ratio of 107 dB and the A-weighted figure is 117 dB(A), both with and without emphasis.

The channel separation on both left and right channels is better than 90 dB for signals up to 1 kHz, but both channels exhibit substantially less separation for signals above 10 kHz. The 20 kHz separation for left channel into right channel is only 66.3 dB which is the lowest channel separation figure for any CD player that we have yet seen.

The measured distortion at 0 dB (maximum output level) is excellent and the high ▶

MEASURED PERFORMANCE OF TECHNICS SL-P8 Serial No. 390TL022

FREQUENCY RESPONSE

FREQUENCY	OUTPUT LEVEL dB
1.0kHz	0.0
20Hz	-0.2
40Hz	-0.3
100Hz	0.0
200Hz	0.0
500Hz	0.0
1.0kHz	0.0
5.0kHz	-0.2
10.0kHz	-0.7
16.0kHz	-1.0
20.0kHz	-1.0

LINEARITY

RECORDED LEVEL dB	OUTPUT LEVEL dB
0.0	0.0
-1.0	-1.0
-3.0	-3.0
-6.0	-6.0
-10.0	-10.0
-20.0	-20.0
-60.0	-60.0
-80.0	-79.8
-90.0	-91.3

EMPHASIS

Frequency	Recorded Level	Output Level (Left)		Output Level (Right)	
1kHz	-0.37dB	-0.2	dB	-0.2	dB
5kHz	-4.53dB	-4.6	dB	-4.5	dB
16kHz	-9.04dB	-10.0	dB	-9.7	dB

PITCH CONTROL -3.5% to + 5.3%

CHANNEL SEPARATION

FREQUENCY	RIGHT INTO LEFT dB	LEFT INTO RIGHT dB
100Hz	97.2	91.1
1kHz	96.5	92.4
10kHz	82.3	82.2
20kHz	77.9	66.3

DISTORTION AT MAXIMUM OUTPUT LEVEL = 0dB

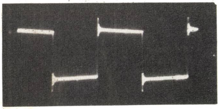
	100Hz	1kHz	10kHz	
2nd	-98.2	-95.7	-91.5	dB
3rd	-89.3	-106.3	out	dB
4th	-101.4	-106.1	of	dB
5th	-109.1	-108.4	Range	dB
T.H.D.	0.0037	0.0018	0.0027	%

AT INDICATED LEVELS FREQUENCY = 1kHz

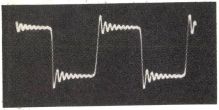
	Level = - 10dB	Level = -20dB	Level = -60dB	Level = -80 dB	
2nd	-	-	-	-	dB
3rd	-100.6	-92.3	-44.3	-32.5	dB
4th	-104.2	-	-	-	dB
5th	-97.1	-96.1	-	-26.2	dB
T.H.D.(%)	0.0019	0.0029	0.61	5.4	%
T.H.D.(dB)	-94.4	-90.8	-44.3	-25.4	dB

SIGNAL TO NOISE RATIO

Without Emphasis	107dB(Lin) 117dB(A)
With Emphasis	107dB(Lin) 117dB(A)



100 Hz



1 kHz

level figures are generally comparable with the other two machines. These figures do not significantly deteriorate till −60 dB where the distortion is still only 0.61%, while at −80 dB it is only 5.4%.

The measured emphasis characteristics are reasonably close to the theoretical performance. Taken overall, the objective performance of the SL-P8 CD player is excellent and it offers unusually good linearity and low distortion and an unusually wide dynamic range.

Subjectively

The subjective evaluation of these three machines was a real pleasure as I was provided with two copies of the same disc and, more importantly, the same music but from a different recording company. (By playing the two copies on two out of the three CD players in parallel I was able to listen to the differences between any two machines while the same program content was repeated sequentially on each of these machines.)

One of the two copies of Gustav Holst's 'The Planets' is conducted by Herbert von Karajan with the Berlin Philharmonic Orchestra (Deutsche Grammophon 400 028-2). By playing the same music with Lorin Maazel conducting the French National Orchestra (on Sony-CBS disc 38DC 12) I was able to compare the differences in orchestration, production and recording quality of two of the largest current recording companies (and most probably the largest future CD producers).

These records were supplemented by a series of equally superb classic and pop discs from other sources. These included Dvorjak's '9th Symphony' (The New World) with Lorin Maazel conducting the Vienna Philharmonic Orchestra (Deutsche Gramaphone 410 032-2), Elton John's 'Too Low For Zero' (Rocket 811 052-2) and 'Charlie' (Polydor 813662-2).

Unlike many of the other CD discs and conventional records that you may have heard, these discs were all digitally recorded to provide base material with dynamic ranges matching the capabilities of the medium. In particular, 'The Planets', Elton John and Dvorjak's 'The New World Symphony' would be regarded as 'AA' classification records for both content and recording quality, but they have been conventional microgroove discs. Even as CD discs they must rank amongst the better or best of those currently available, in terms of recording quality and their overall technical attributes.

Elton John's performance on 'Too Low for Zero' would be unquestionably one of the best renditions of his work that I, or any of my family, have yet heard. This disc provides superb material and another, by virtue of the quality of the voice material. 'Charlie' contains some of the newest and best synthesised music I have yet heard and provides electronic percussive material to 'tickle the fancy' of any digital-to-analogue convertor, quite apart from the filter networks that follow.

The listening task was pleasant although arduous. The assessment of the audible differences between the three machines was a different matter. The big question, of course, was what differences were there and were they audible? Having already written something on the subject myself and having read a great deal more by other reviewers, I experienced increasing trepidation as I proceeded with this difficult task.

The first and most significant different that I perceived was that at normal listening and recording levels (i.e: in the range 0 dB to −50 dB) I was unable to detect any substantial difference on either speech or normal high level classical music. At lower levels in the range of −50 dB to −80 dB, and particularly on transient material on the 'Charlie' disc, I was able to detect and even on occasions pinpoint audible differences between the machines.

A number of reviewers have presented statements on the superiority of the Philips CD disc player, stating strong preferences for this machine when compared to others that they have reviewed. I must acknowledge that I was able to detect, and on occasions readily hear, differences between the Technics machine and this machine which is a very similar unit to the Marantz player.

Unlike the English and one American reviewer (who were comparing a different Philips machine with a different comparison machine), I found that the Technics player had a slightly cleaner response. I believe that it had a slightly purer sound than that provided by the Philips and Marantz players at very low levels.

The only explanation that I can give fo this relates to the replay linerarity of the digital-to-analogue decoder in the Technics player; I suspect that this is coupled with the lower distortion that this unit exhibits. Taken overall, and on a far more objective level, the three machines produced superlative sound that I fear you would be har pressed to fault even with an arduous A-B testing sequence of the type I used.

The only major difference between thes machines relates to their individual functional and ergonomic controls, their supplementary controls (like the availability of a optional remote control which I woul recommend) and their individual prices. I is still clear that in terms of value for mone the lowest price players still have an edg over the highest price players in the cost conscious market place.

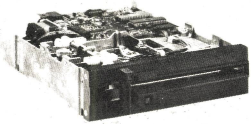
With a recommended retail price of onl $899 the Marantz player has an awful lo going for it and undoubtedly offers the bes value for money for an intending purchaser

By contrast, with such unusual features a pitch control, full infrared remote contro (presumed at extra cost), music scan and 3 sequence programmable sequence control the Technics machine technically has a grea deal going for it. The Philips CD 303 hap pens to have attributes lying in betwee these two options as it neither offers th option of being able to add the remote con trol to it, nor does it offer anything extra b way of smart appearance or cost advantage

In the end, I doubt if you will buy player on the basis of this review. Howeve if you do you are certain to get the bes value for your money and if technical per formance is the 'name of your game', the the best technical performance as well.

It has been claimed that compact discs are indestructible.
However, it has been proved that if they are mishandled, the sound quality will deteriorate.

TANDON DISK DRIVES



TANDON NEW EIGHT-INCH THINLINE DISK DRIVES

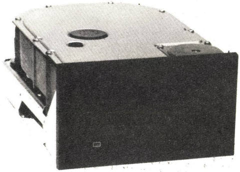
- Direct drive.
- Proprietary, high-resolution, read-write heads patented by Tandon.
- D.C. only operation—no A.C. required.
- Industry standard interface.
- Three millisecond track-to-track access time.

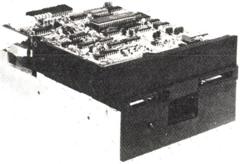
TANDON MODEL TM500 SERIES WINCHESTER DISK DRIVES

Tandon's low cost 5¼″ rigid disk drive features an on-board microprocessor which calculates the optimum positioning algorithm, yielding an Average Access Time of 110 milliseconds. This product family includes 1, 2, and 3 platter models with unformatted capacities of 6.4, 12.8, and 19.1 megabytes, respectively.

Up to four Tandom TM500's can be daisy-chained on a single bus, which provides a capability of up to 76 megabytes of on-line storage (unformatted) in a single system.

These drives are compatable with controllers that use an industry standard interface (ST 506).





Tandon Model TM-100 Mini-Floppy Disk Drives

Tandon's TM-100 family of mini-floppies offer the absolute highest storage capabilities of any 5¼″ high-speed, random access disk drive available in two single head and two double head models, all double density.
Unsurpassed Storage Capacity—Up to an incredible 1000K bytes information on 160 tracks. Recording density is 5877 BPI.
Advanced Dual-Head Design—Tandom Magnetics has for years been the leading designer and supplier of read/write heads to most major disk drive manufacturers.
Increased Throughput—Tandon's TM-100 have a track-to-track access time of only 5 milliseconds (an incredible 3 milliseconds double track density).
Proven Reliability—Designed for total reliability, as demonstrated by more than 50,000 production models in operation.

AE ADAPTIVE ELECTRONICS P/L

418 St. Kilda Rd. Melbourne, 3004. Phone (03) 267 6800
Sydney: Phone (02) 419 5579. Newcastle: Phone (049) 23 343

IDIAK II-FAST CP/M 2.2 COMPUTER

COLOSSAL 2.8 MBYTES
BETTER THAN 8″ SPEED
AND CAPACITY

EXCELLENT VALUE!

IDEAL FOR BUSINESS
OR SERIOUS HOBBYIST

Computer Prices:

$1999	2 Disk Drive	IDIAK II
$1450	1 Disk Drive	IDIAK II
$ 590	1 Drive Upgrade Kit	

(sales tax, pack & post included)

★ FEATURES

- Faster than 8″ Disk Systems
- 1.4 Mbytes Formatted per Drive High Double Density Double Sided
- Z80A 4MHz CPU
- 64K RAM
- 2 x RS232 I/O Ports
- 1 x Centronics Port
- 2 Slim-line 5¼″ Drives (Optional 1 Drive)
- Interfaces to terminal or to your personal computer acting as terminal
- Includes CP/M 2.2 Software

Accessory Prices:

10	High Density Disks	$110
1	High Density Disk	$ 12
1	Centronics Cable	$ 45
1	Terminal Cable	$ 40
	Pack & Post	$ 2

IDIAK
COMPUTER PRODUCTS

10A Bannister Street, Fremantle, 6160, W.A.
P.O. Box 694, Fremantle, 6160, W.A.

CIVILIZATION DISCOVERS XIDEX.

Like the discovery of fire, Xidex Precision Flexible Disks herald a new era for civilization.

They are the most advanced and durable disks technology has produced and far exceed all known Industry standards world-wide. Even the disk jacket is 33% thicker than the industry standard for greater protection from contaminants, and extended handling.

Xidex 5¼″ and 8″ disks carry a 10-year warranty. They are guaranteed 100% error-free and 100% precision made with a range to suit all Computer and Word Processing systems.

Phone Magmedia and discover Xidex yourself.

magmedia
Supplies and accessories for your computer

SYDNEY (02) 816 3222
MELBOURNE (03) 699 9688
BRISBANE (07) 229 1600
CANBERRA (062) 47 2322
PERTH (09) 328 3311
ADELAIDE (08) 223 6261
HOBART (002) 34 4522

COURT DECISION PROMPTS SOFTWARE LEGISLATION

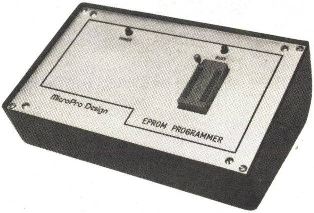
Following the shock decision by the Federal Court whereby Apple lost its software piracy case against Computer Edge, the Australian software industry will seek talks vith the Attorney-General's Department as soon as possible.

The Australian Computer Society's software industry committee and the Australian Software Houses Association both welcomed the decision, believ ng it will clarify the situation.

The ACS-SIC national chairman, Karl Reed will ask the Attorney-General's Department o set up a working party of legal xperts and industry repres ntatives to study legal proposals or the drafting of software pro ection legislation, which the ndustry sees as an urgent equirement.

ASHA president, Ian Dennis ccused the Attorney-General's Department of waiting for other countries to act first. Japan proposes to introduce legislation next year on software protection.

In Australia, legal protection of original material is covered by different Acts and administered by different government departments: the Copyright Act is administered by the Attorney-General's Department and patent trademark, and industrial design legislation is administered by the Department of Science and Technology. Neither the ACS or the ASHA want the Copyright Act as the only means of software protection.



EPROM PROGRAMMER

MicroPro Design has announced the availability of three new versions of their EPROM programmer which have been designed for use with the Osborne 1, Apple II and VIC-20 microcomputers.

These units retain all the features of the original design used with the Commodore CBM style computers, including the ability to read and program all currently available 24 pin EPROMs.

The EPROM programmers are simple yet versatile devices, operating under the control of a program executed in the host computer. Commands are entered in response to menus presented on the screen of the computer. The commands allow simple operations such as READ, PROGRAM, VERIFY or ERASE CHECKING to be performed easily.

The programmers are available through microcomputer retailers throughout Australia, or directly from **MicroPro Design, P.O. Box 153, North Sydney NSW 2060. (02)438-1055.**

DRUM PLOTTERS BOOM?

Anderson Digital Equipment (ADE) has announced the availability in Australia of two of the major Houston Instrument drum plotters, the CPS-19 and the recently-released DMP-40.

A single-pen drum plotter, the DMP-40 features pen speeds of up to 4.2 ips and a format size of up to 11" x 17" (279.4 mm x 431.8 mm) and is ideally suited o a laboratory environment.

The DMP-40 can automatically generate circles, arcs, ellipses and general curves on command. Five different character sets are resident in ROM, which may be presented normally, or as italics, and at 225 possible sizes and 360 different degrees of rotation.

For further information, contact **ADE, 14 Whiteside Road, Clayton Vic. 3168. (03)544-3444.**

DISK DRIVE

A disk drive system that will enable Apple II personal computers to run software programs based on the widely used MS-DOS operating system has been announced by Rana systems and Apple Computer.

The Rana 80862/2 is a plug-compatible co-processor and dual disk drive system for Apple II Computers. The product uses an 8086 microprocessor, with a double-sided drive providing 360K of storage per drive. The co-processor portion will provide 256K of main memory expandable to 512K.

For further information contact **Burson-Marstellar, 19th Floor, 1 York St, Sydney NSW. (02)241-3016.**

SOURCEWARE TO SOURCE IBM ADD-ONS

Sourceware has been appointed the Australian listributor for AST Research, one of the leading US suppliers of add-on products for the IBM Personal Computer.

AST Research produces more han 20 hardware and software ccessories for the IBM PC in hree categories — communica ion products, multifunction memory cards, and system enhancements.

AST products were voted first n two categories in a contest onducted by the US magazine PC World among its readers and reported in the September issue. The "Super Drive" was voted the most popular disk emulation program and "Combo Plus (256K)" the most popular combination memory board.

Based in Irvine, California, the company markets products worldwide through more than 700 distributors and dealers and has achieved sales of more than $2 million a month.

Sourceware's Managing Director Mr Doug Ruttan said AST had focussed its product line on the office and business automation usage of the PC with emphasis on mainframe communications and local area networking.

Several products have enabled many installations to communicate between mainframes and personal computers, and file serving, electronic mail and disk sharing was now possible with AST's networking.

For further information, contact **Sourceware, 4/73 Albert Avenue, Chatswood NSW 2067. (02)411-5711.**

UP TO 10 NEW KITS ADDED EACH MONTH.

WHAT A RANGE

HEY KIDS!

(Big ones and little ones)

FOR FEBRUARY ORDERS
LESS 7.5%
FOR 10 OR MORE MIXED KITS.
LESS 10% FOR
25 OR MORE KITS.

THE NEW SCHOOL
Then build a kit
Not only educational—but

Board No	PCB Price	Description		Kit price
EA6800	$15.50	6800 Micro computer		$119.00
EA6802	$15.50	6802 Micro computer		$119.00
		Power supply to suit		$35.00
		Hex keypad 19 keys		$39.50
75L11	$2.50			
78UP10	$9.50	2650 extra ram	OCT 78	
79FE11	$3.50	Photo flash exposure mtr.	NOV 79	$24.50
79PC9	$3.90	Pulse generator	SEP 79	
79SE3	$4.90	Train model sound	MAR 79	
79TI11	$3.90	Transistor assisted Ign.	NOV 79	$34.50
79PS11	$2.90	Experimenters power sup.	NOV 79	
79PC12	$2.90	Fan speed control	DEC 79	
79SF10	$2.50	Photo slave flash	OCT 79	
79SF9	$2.90	Photo sound trigger	SEP 79	
79UPS6	$3.90	Universal power supply	JUN 79	$34.50
80ST10A	$3.90	Stylus timer	OCT 80	
80ST10B	$3.50		OCT 80	
80TC12	$3.90	Bipolar train controller	DEC 80	$34.50
80CM3A	$4.90	Digital capacitance mtr.	MAR 80	$49.50
80CM3B	$3.90		MAR 80	
80PG6	$7.90	TV pattern generator	JUN 80	$67.50
80TV8	$4.50	TV CRO adapter inc. p/pack	AUG 80	$39.90
80F3	$3.20	Audio prescaler	MAR 80	
80PP3	$2.50		MAR 80	
80LL7	$3.90	Leds & ladders	JUL 80	$19.50
80B7	$2.50	Beat frequency oscillator	JUL 80	
80BM10	$3.90	Car battery monitor	OCT 80	$11.50
80DC10	$6.50	Digital storage CRO ad.	NOV 80	$89.90
80HLA5	$2.90	Car headlight alarm	MAY 80	
80LS12	$3.50	Selectalott	DEC 80	$22.00
80LBR12	$2.90	Light beam relay	NOV 80	$13.00
80PC4	$2.90	Power heat controller	APR 80	
80PC7	$3.50	Power saver induc mtr	JUL 80	
80G6	$5.90	Musical tone gen.	JUN 80	
80GPS3	$2.90	Voltage regulator multi	MAR 80	
80AU3	$3.50	Hifi auto turn off	MAR 80	
80AW4	$4.50	Receiver all wave	APR 80	
80TM8A	$6.90	Digital engine analyser	AUG 80	$49.50
80TM8B	$2.90		AUG 80	
80PP7A	$8.50	Eprom programmer	JUL 80	$79.50
80PP7B	$3.90		JUL 80	
80RF5	$2.90	Rumble filter	MAY 80	
80SA3	$5.90	Playmaster stereo amp.	MAR 80	
80CH7	$8.50	240V ac light chaser	JUL 80	
80RAM12	$5.90	Ram expansion for dream	DEC 80	$39.00
80PA6	$7.50	Playmaster 300W amp module	JUN 80	$63.00
80CL4	$3.50	Timer controller	APR 80	
80TRS11	$2.90	TRS 80 printer serial in.	NOV 80	$17.50
80SA10	$9.90	Playmaster mosfet stereo amp.	JAN 81	
80AD12	$3.00	Autodim light dimmer	JAN 81	$32.00
80RM12	$3.90	Cylon voice simulator	JAN 81	$19.95
80FB12	$3.90	Guitar fuzz box	FEB 81	$19.90
81SW1	$3.90	Osc. switch dual trace	FEB 81	$60.00
81SP1	$2.90	TRS 80/SYS 80Serial interf.	FEB 81	
81GA3	$11.50	Color graphic analyser	MAR 81	$109.00
80GA12	$6.50	25W guitar amplifier	MAR 81	
81DC2	$3.50	Le Gong doorbell	MAR 81	$14.95
81DC3B	$8.50	Digital and	MAR 81	$189.00
81DC3A	$9.50	Analogue storage CRO	MAR 81	
81IR4	$4.50	Infra-red relay receiver	APR 81	$39.00
81RC4C	$2.90	Infra-red relay transmitter	APR 81	
81HB4A	$7.50	Heart rate monitor	APR 81	$82.00
81HB4B	$3.50		APR 81	
81MA4	$4.50	Touch sensitive alarm	APR 81	
81VM2	$2.90	High impedance DC voltmeter	APR 81	
81SI3	$7.90	TRS 80/SYS serial interf.	APR 81	
81RC4A	$4.90	2 channel (receiver)	MAY 81	$72.00
81RC4B	$2.50	Infra-red remote (preamp)	MAY 81	
81RC4C	$2.75	Control (transmitter)	MAY 81	
81SP5	$2.90	Sound pressure meter	MAY 81	$37.00
81CC5	$2.90	PC birdies	MAY 81	$14.50
81SS4	$4.90	Speed sentry	MAY 81	
81DT5	$3.00	Dream tape controller	MAY 81	
81MP6	$3.90	Microprocessor power supply	MAY 81	
81AO6	$4.90	Audio oscillator	JUN 81	$59.00
81UA6		Benchmate power supply	JUN 81	
81MC7	$2.90	Moving coil preamp	JUL 81	
81OR7	$9.50	Electrochume (electr. organ)	JUL 81	$59.00
81P6	$2.90	Pools/lotto selector	JUL 81	$22.50
81SW7	$4.90	Electronic steam whistle	JUL 81	$17.50
81MC8	$10.90	Musicolor IV	AUG 81	$84.00
81SM7	$3.90	Bagatelle	AUG 81	
81CL9	$4.00	Digital clock/thermometer	SEP 81	$80.00
81GA9	$4.90	Photon torpedo game	SEP 81	$24.50
81UC8	$4.50	Universal timer & stpwatch	SEP 81	
81WS10	$4.90	Wind universal indicator	OCT 81	$52.50
81AO10	$3.50	Audio test unit cass. deck	OCT 81	$47.50
81SS11	$8.90	Slide cross fader	NOV 81	$99.50
81SG9	$4.20	Led sandglass	NOV 81	$22.50
81AU11	$3.90	Audible turn indicator	NOV 81	
81FM10A	$5.90	500MHZ digital freq. mtr.	DEC 81	$135.00
81FM10B	$3.90		DEC 81	
81CH12	$3.50	Christmas decoration	DEC 81	
81LD12	$4.50	Led bar graph display	DEC 81	
81MI11	$3.90	Metronome (low current)	JAN 82	
81WD12A	$3.50	Wind direction indicator	JAN 82	$24.50
81WD12B	$3.50		JAN 82	
81P19	$6.90			
82EP1	$12.50	Free standing eprom prog	JAN 82	$45.00
		with '24 pin' textool socket		$55.00
		and AC plugpack		$69.50
82TH2	$3.90	Digital thermometer	FEB 82	$79.00
82CR1	$13.50	Lge. scrn. storage CRO Adapt	FEB 82	$119.00
82EG2	$3.90	Cudlip	FEB 82	$12.95
82PS2	$4.90	Dual tracking power supply	MAR 82	$87.50
82LF2	$3.90	Low fuel indicator	MAR 82	$16.50
82CM3	$3.90	LCD capacitance meter	MAR 82	$79.00
82AO3A	$7.90	Function generator	APR 82	$79.50
82AO3B	$3.90		APR 82	
82VC3	$3.50	Voice canceller	APR 82	$22.50
82VX4	$3.50	Vox	APR 82	$15.00
82VS10				
82PT4	$3.90	Photographic timer	APR 82	$48.00
82IV5	$5.40	12-240V inverter 40 watt	MAY 82	$49.50
82P5	$5.90	Universal preamp MM/MC	MAY 82	$35.00
82TO5	$3.90	Tacho/dwell meter	MAY 82	$72.50
82TS3	$3.90	Low cost touch switch	MAY 82	$12.00
82GA5	$9.90	Guitar booster	JUN 82	$17.50
82EM6A	$4.90	Theremin	JUN 82	$34.50
82EM6B	$3.90			
82IV6	$8.90	12-240V inverter 300 watt	JUN 82	$195.00
		Power monitor	JUL 82	$18.00
82HB6	$3.90	LDC heart rate monitor	JUL 82	$79.00
82CC7A	$15.50	Car computer	JUL 82	$109.00
82CC7B	$4.00	Car computer	to SEP 82	
82DP6	$4.90	Decimal point for D.G. meter	JUL 82	$70.00
82PA7	$9.50	Sub woofer amp	JUL 82	$85.00
82UR8	$4.90	Ultrasonic rule	AUG 82	$49.00
82MS8	$6.50	Stereo synthesizer	SEP 82	$55.00
82EF9	$4.90	Electric fence	SEP 82	$19.50
82PC8	$2.00	Fluorescent starter	OCT 82	$5.00
82FC8A	$6.50	Digital readout	OCT 82	$72.00
82FC8B	$3.90	For short wave	OCT 82	
82FC8C	$2.50	Receivers	OCT 82	
82TA10	$3.90	Freezer alarm	OCT 82	$21.00
82VS10	$7.90	Speech Synthesizer	OCT 82	
82PC10	$3.90	Power up	NOV 82	$36.00
82AL11	$3.90	Super siren	NOV 82	$23.50
82PC11	$3.90	Driveway sentry	DEC 82	$32.00
82QR12A	$9.95	Playmaster AM tuner	DEC 82	$239.00
82QR12B	$9.95		DEC 82	
82PH12	$4.90	Digital PH meter	DEC 82	$135.00
82EG12	$2.90	Boggle goggles (short form)	DEC 82	$9.60
82FD5	$4.90			
82DP6	$3.90			
83TV1A	$4.90	Remote infrared TV	JAN 83	$39.50
83TV1B	$2.90	Sound control	JAN 83	
83TV1C	$2.90		JAN 83	
83PS1	$3.90	Plugpack regulator	JAN 83	$14.00
		with plugpack		$29.50
83EG1	$3.50	Led head light chaser	JAN 83	$12.00
82WB1	$2.90	Wheatstone bridge	FEB 83	$45.00
82AO2	$2.90	AM tuner alignment kit	FEB 83	$8.00
		Moisture alarm	FEB 83	
79TI11	$3.90	Trans.ass. ignition updated	FEB 83	$34.50
83FC2		Fuel consumption meter	MAR 83	$50.00
83BP3	$3.90	Brown out protector	MAR 83	$25.00
83MS4	$3.90	Stereo simulator PCB version	APR 83	$12.00
		Self contained unit	AUG 83	$20.00
83PC3A	$3.90	Touch lamp dimmer	APR 83	$20.00
83PC3B	$3.50	Touch lamp timer	AUG 83	$21.00
83PS5	$4.90			
83SC7	$3.90	LCD event counter	JUL 83	$32.00
83SC8	$3.50	2MHZ digital freq. meter	AUG 83	$60.00
83VA8	$5.90	Video amplifier	AUG 83	$15.00
83EG5	$4.90	Electronic roulette wheel	MAY 83	$24.00
		Electronic breath tester	MAY 83	$25.00
83PS5	$5.90	50V/5A power supply	JUNE 83	$140.00
83GA6	$7.90	Effects unit	JUNE 83	$75.00
83PP5	$5.90	Overload indicator	JUNE 83	$20.00
83PS7	$3.50	±12V for lab power supply	JULY 83	$13.00
83AL6	$2.90	Fridge door alarm	JULY 83	$9.00
83MS4	$3.90	Compumuse	AUG 83	$20.00
83WM8	$6.95	Electronic watt meter	SEPT 83	$65.00
83TT8	$3.95	Transistor tester	SEPT 83	$15.00
83MS8	$4.90	Soil heating unit	SEPT 83	$70.00
83VE10	$4.90	Video enhancer	OCT 83	$35.00
83MD9	$3.50	Nail finder	OCT 83	$10.00
83SS9	$3.90	Speed sentry	OCT 83	$11.00
ET014	$4.90	Dual voltage power supply	DEC 71	
ET043	$2.50	Heads or tails	OCT 76	$3.90
ET044	$2.50	Two tone doorbell	OCT 76	$4.90
ET047	$2.50	Morse practice set	DEC 76	$3.90
ET048	$2.50	Buzz boards	DEC 76	$4.50
ET061	$2.50	Simple audio amp	OCT 76	$5.90
ET062	$2.90	Simple AM tuner	MAR 77	$6.90
ET063	$2.90	Electronic bongos	NOV 79	$5.90
ET064	$2.50	Simple intercom	OCT 83	
ET065	$2.90	Electronic siren	DEC 79	$5.90
ET066	$2.50	Temp alarm	DEC 79	$5.50
ET067	$2.90	Singin moisture		$7.95
ET068	$2.90	Led dice	OCT 76	$6.90
ET071	$2.50	Tape noise limiter	JUN 79	
ET072	$2.50	Two octave organ	JUN 78	$9.50
ET081	$2.90	Tachometer	OCT 83	
ET083	$2.50	Train controller	DEC 79	
ET084	$2.90	Car alarm	JAN 77	$13.50
ET085	$2.50	Car over rev. alarm	OCT 79	
ET130	$2.50	Temp/volts converter	FEB 76	
ET132	$3.90	Experimenters power supply	FEB 77	
ET134	$2.90	R.M.S. voltmeter	AUG 77	
ET135	$3.50	Digital panel meter	OCT 77	
ET136	$2.90	Linear scale cap. meter	MAR 78	
ET137A	$4.90	Frequency meter LCD	MAY 78	
ET137B	$3.90	Audio oscillator	MAY 78	
ET139	$2.50	Power meter	MAY 78	
ET147	$4.90	Electronic dummy load	OCT 80	$99.00
ET149	$3.50	Two tone generator	JUL 80	$34.90
ET152	$2.90	Capacitance meter	FEB 80	
ET153	$3.50	Temperature adaptor	MAY 83	$19.95
ET157	$4.90	Crystal marker	OCT 81	$37.50
ET158	$3.50	Low Ohms meter	NOV 81	$36.50
ET159	$2.90	10-15V exp. scale voltmeter	DEC 81	$26.50
ET160		13.8V 10 amp power supply	JUL 82	
ET161	$4.90	Evaluation meter		
ET162	$4.50	0-30V var. power supply	DEC 82	$47.50
ET163	$6.50	0-40V/5A alb power supply	MAY 83	$169.00
ET164	$8.00	Zener diode tester	MAY 83	$9.00
ET166		Frequency counter	AUG 83	$16.00
ET166B	$4.90			
ET166C	$4.90			
ET166D	$4.90	Power supply	AUG 83	$24.00
ET165	$7.50	Tacho calibrator	NOV 82	$39.50
ET245	$2.90	White line follower	NOV 77	
ET255	$2.90	Thermometer	NOV 80	
ET256	$3.50	Humidity meter	OCT 83	$29.50
		Humidity sensor	OCT 83	$19.95
ET257	$2.90	Universal relay board	MAY 81	$13.50
ET258	$2.50	Mini drill speed controller	JUL 81	$9.50
ET259A	$3.90	Versatile 'incremental' timer	JAN 82	$39.00
ET259B	$3.90			
ET260	$2.60	Photo lamp flasher	DEC 79	

REMEMBER WHEN YOU BUY A KIT OFF US, WE ARE THE ONES WHO PUT IT TOGETHER.

bankcard
welcome here

WE CAN NOW
PRODUCE OVER
300 KITS.

ROD IRVING ELECTRONICS

ROD IRVING ELECTRONICS
425 High St., Northcote, Vic. 48-50 A'Beckett St., Melb., Vic.
Phone (03) 489 8866, (03) 489 8131, Mail Order Hotline (03) 481 1436
Mail orders to P.O. Box 235 Northcote 3070 Vic.

Minimum P & P $3.00. Errors & omissions excepted.
Please address tax exempt, school, wholesale and dealer enquirie

RITRONICS WHOLESALE
1st floor 425 High St. Northcote 3070 (03) 489 7099 (03) 481 1923

BUY DIRECT FROM THE KIT PEOPLE. WE ENDEAVOUR TO HAVE AS MANY KITS IN STOCK AS POSSIBL
SAVE! SAVE! SAVE! SAVE! BUY DIRECT.

UP TO 10 NEW KITS ADDED EACH MONTH.

YEAR IS HERE.
from our huge range!
it is fun to get one going

REMEMBER BY DIRECTLY IMPORTING OUR OWN COMPONENTS OUR KITS ARE CHEAPER AND BETTER. ROD IRVING.

HEY KIDS!
(Big ones and little ones).

Board No	PCB Price	Description		Kit price
ET261	$2.90	Fog horn	DEC 79	
ET263	$2.90	Simple egg timer	DEC 79	
ET264	$2.90	Simple siren	MAR 80	
ET265	$3.90	Power down	JUL 83	$37.00
ET268	$2.50	Nicad float charger	MAR 83	$9.50
ET316	$3.50	Transistor assisted ignition	MAY 77	$34.00
ET317	$3.90	Car rev monitor	JUL 77	
ET324	$4.90	Led tacho	AUG 80	$34.00
ET323	$3.90	Headlight delay	MAY 83	$17.50
ET325	$2.50	Car auto electric probe		
ET326	$2.50	Exp. scale led voltmeter	SEP 80	$12.50
ET327	$3.50	Turn/Hazard indicator	OCT 80	$22.00
ET328	$2.90	Led oil temp meter	JAN 81	$19.00
ET329	$2.50	Exp. scale vehicle ammeter	FEB 81	$19.00
ET330	$3.90	Car alarm	JUL 81	$29.00
ET332	$3.90	Electronic stethoscope	AUG 81	$34.00
ET333	$3.90	Reversing alarm	JAN 82	$10.00
ET334	$3.90	Auto tester	JAN 83	
ET335	$4.50	Windscreen wiper controller	MAR 83	
ET336	$3.90	Low cost tacho dwell	AUG 83	$24.00
ET363	$3.50			
ET417	$2.90	Overload indicator	AUG 73	
ET421		Three way (Dick Smith)	SEPT 83	
ET438	$3.90	Led level meter		$12.95
ET440	$8.50	25 Watt stereo amp	MAR 75	
ET445	$2.90	General purpose preamp	JUL 76	$8.25
ET446	$3.90	Stereo limiter	JUL 76	
ET449	$3.90	Mike preamp	MAY 77	
ET450A	$4.90	Bucket brigade	DEC 77	
ET450B	$4.90			
ET452		Guitar practice amplifier	JAN 80	
ET453	$2.90	Amp class B gen purpose	APR 80	
ET454	$3.90	Fuzz box	APR 80	
ET455	$4.50	Loud speaker protector	MAR 80	$32.50
ET457	$3.90	Scratch & rumble filter	SEP 80	$49.50
ET458	$4.90	Led level meter	JUN 81	$27.00
ET459A	$16.50	Series 5000 1/3 oct graph equ	NOV 82	$199.00
ET459B	$16.50			
		Graphic equ. front panel		
		Graphic equ. metal work		
ET461	$3.90	Balanced input preamp	DEC 82	$20.00
ET464	$2.90	IC audio amplifier	JUL 83	$8.00
ET465	$4.50	Loud Hailer	JUL 83	$50.00
ET466	$8.50	300W amp module	FEB 80	$67.50
ET467	$6.90	4 input mike preamp	JUL 80	$29.50
ET470	$4.50	60 watt amp module series 4000	TPV 6	$26.00
ET471	$9.90	Audio preamp series 4000	TPV 6	$49.50
		Series 4000 front panel		$14.90
		Series 4000 metal work		
ET472	$4.50	Power supply for series 4000	TPV 6	$24.00
ET473	$5.90	Moving coil preamp series 4000	TPV 6	$54.00
ET474	$2.90	Interface 60W amp	JAN 80	
ET475	$6.90	AM tuner	SEP 80	$99.00
		Set of three pot cores		$29.50
ET476	$7.90	Series 3000 amp 25W stereo	NOV 80	$84.00
ET477	$7.90	Series 5000 pwr. amp mod 150W	JAN 81	$63.50
		Series 5000 power amp complete kit		$319.00
		Series 5000 pwr amp front panel		
		Series 5000 pwr amp metal work		
ET478MB	$13.90	Series 5000 preamp main brd	OCT 81	
ET478MC	$4.90	Moving coil preamp (5000)	SEP 81	$24.50
ET478MM	$4.90	Moving magnet preamp (5000)	SEP 81	$18.50
ET478SA	$2.90	Series 5000 preamp switch brd	OCT 81	
ET478SB	$1.90	Series 5000 preamp switch brd	OCT 81	
ET478SC	$1.90	Series 5000 preamp switch brd	OCT 81	
ET478SD	$1.90	Series 5000 preamp switch brd.	OCT 81	
ET479	$3.50	Series 5000 bridging adaptor	MAR 82	$12.90

Board No	PCB Price	Description		Kit price
		Series 5000 preamp complete kit		$259.00
		Series 5000 preamp front panel		
		Series 5000 preamp metal work		
ET480	$4.50	100 watt amp module	30 AP	$25.50
ET480PS	$4.50	50-100W amp module pwr supply	30 AP	$22.50
ET481M	$3.95	Hi-power p.a./guitar amp mod.	30 AP	
ET481PS	$4.90	12V/100 p.a. inverter	30 AP	
ET483	$4.50	Sound level meter	FEB 78	
ET484	$5.90	Expander compressor 30 AP	JUL 77	
ET485	$5.25	Graphic equaliser	JUN 77	
ET486	$4.90	Howl round stabilizer	NOV 77	$59.00
ET488	$7.90	60W amp module	JAN 83	
ET489A	$3.50	Audio spectrum analyser no2	APR 78	
ET489B	$3.50			
ET492	$3.90	Sound bender	FEB 82	$29.00
ET494	$3.90	Loud speaker protector	OCT 82	$24.50
ET496	$8.90	Series 4000-1 speaker kit	FEB 80	$779.00
		Speakers & crossovers		$499.00
		Crossover kits		$199.00
		Speaker boxes (prices per pair)		$299.00
ET499	$4.95	50W mosfet amp 75-85	MAR 82	$79.00
		Transformer		$43.50
		Anodised heatsink		$42.50
ET525	$4.90			
ET527	$5.90			
ET528	$2.90	Intruder alarm	JAN 75	
ET539	$3.90	Touch switch	MAR 76	
ET541	$3.90	Train controller	MAY 76	
ET547	$3.50	Telephone bell extension	JUN 77	
ET549A	$3.90	Metal detector	MAY 77	
ET560	$2.50	240V mains locator	MAY 80	
ET561	$3.90	Metal Detector	MAR 80	$34.00
ET562	$3.90	Geiger counter	APR 80	
ET563	$4.50	Nicad fast charger	JUL 80	$59.95
ET566A	$2.90	Pipe & cable locator	APR 80	
ET566B	$4.90			
ET567	$4.50	Core balance relay	APR 81	$44.50
ET568	$2.90	Photo flash trigger	OCT 80	$26.50
ET570A	$2.90	Infrared 'trip' relay TX	JAN 82	$24.50
ET570B	$3.20	Infrared 'trip' relay RX	JAN 82	
ET572	$4.90	Digital pH meter with probe	DEC 80	$109.00
ET573	$4.50	Universal timer	OCT 79	
ET575	$2.90			
ET576	$8.90	Electromygram	TPV 6	$95.00
ET577	$3.50	General purpose power supply	TPV 6	$39.50
ET578	$3.90	Simple nicad charger	JUN 80	
ET581	$3.25	15V dual power supply	JUN 76	$17.50
ET583	$2.90	Marine gas alarm	AUG 77	
ET585R	$2.90	Ultrasonic receiver	TPV 6	$17.95
ET585T	$2.90	Ultrasonic transmitter	TPV 6	$10.95
ET586				
ET596	$2.90	White noise generator	NOV 81	$8.00
ET598A	$3.90	Touch switch	FEB 81	$10.00
ET598B	$3.50			
ET599A	$3.50	Infra red remote control	MAY 80	$76.00
ET599B	$3.50			
ET599C	$4.90			
ET599D	$3.20	I.R. remote cntrl power supply	MAY 80	
ET603	$4.90	Music synthesizer sequencer	AUG 77	
ET604	$4.50	Metronome	SEP 77	
ET606	$3.90	Electronic tuning fork	NOV 79	
ET607A	$2.90	Sound Effects generator	AUG 81	$12.50
ET607nf	$2.90		AUG 81	
ET631-2	$7.50	Keyboard encoder	APR 77	
ET635	$4.90	Computer power supply	APR 81	
ET636	$19.90	7 slott s100 mother board	MAY 80	$89.50
ET638A	$5.90	Eprom programmer	JUL 78	
ET640	$69.00	Memory mapped VDU		$129.00
ET644	$69.00	Direct connect modem	OCT 82	$169.00
ET646A	$3.75			
ET646B	$3.75			
ET647		Speech synthesizer	OCT 82	
ET649		Microbee light pen	AUG 83	$19.95

Board No	PCB Price	Description		Kit price
ET650A	$4.90	Stac timer	NOV 78	
ET650B	$4.50			
ET650C	$4.50			
ET653	$6.50	16 Channel comp output driver	NOV 82	$45.00
ET654	$69.00	Gen. purp. interfce. for Apple	MAR 83	$169.00
ET660	$19.00	Learners microcomputer	OCT 81	$99.00
		Key set (18) to suit ET660		$30.00
		Colour option kit to suit 660		$16.50
ET668	$5.90	Microbee eprom programmer	FEB 83	$38.00
		With textool socket		$47.50
ET670	$11.00	Low cost micro keyboard	MAY 82	
ET682	$79.00	Versatile eprom card	MAY 81	$115.00
ET686	$9.50	ppi-based eprom programmer	OCT 82	$48.00
ET688A	$3.50	Bipolar prom programmer	JUL 83	$48.50
ET688B	$3.50			
ET708	$2.90	Aerial amp	MAR 76	
ET713	$4.90	FM tuner add on	SEP 77	
ET717	$4.90	Crosshatch generator	MAY 78	
ET724	$3.90	Microwave leak detector		$16.50
ET726	$3.50	R.F. amp 70W 6/10 meter	FEB 80	
ET729	$3.90	UHF TV masthead amp	APR 81	$36.00
ET730		UHF TV converter	MAY 81	$37.50
ET731	$4.50	Teletype modulator	OCT 79	
ET733	$4.90	RTTY computer decoder	APR 83	$20.00
ET734	$7.90	Phoney patch	MAY 83	$65.00
ET735	$4.90	UHF to VHF convertor	MAY 81	
ET736	$3.90	Radio facs pict-comp decoder	SEPT 83	$25.00
ET760	$3.90	Video mod. to suit 660 micro	OCT 81	$15.50
ET824	$3.90	Slot car power supply	DEC 81	$19.50
ET825	$5.90	Slot car contr. (no case)	DEC 81	$59.00
ET905	$16.00	Polyphonic organ	JAN 83	
ET918	$3.90			
ET1501A	$2.90	Negative ion generator	APR 81	$39.00
ET1501B	$2.90			
ET1501C	$2.00			
ET1503	$3.90	Battery charger	AUG 81	
ET1505	$5.90	12V fluoro. inverter	AUG 82	$49.50
ET1506	$2.90			
ET1509	$4.90	D.C.-D.C. inverter	SEP 82	$39.50
ET1510A	$3.90	Model railway points	JAN 83	
ET1510B	$2.90	Controller and indicators		
ET1511	$3.90	Immersible temp. controller	FEB 83	$19.50
ET1512	$4.25	Electric fence tester	FEB 83	$24.50
ET1515	$3.95	Motor speed controller	APR 83	$27.50
ET1516	$3.90	Model engine ignition system		$41.50
ET1517	$3.75	Video distribution amp	SEP 83	$45.00
ET1520	$3.90	Wideboard amp	JUL 83	$37.00
Hobby Electronics				
HE102	$4.50	Guitar phaser	JUN 81	$25.00
HE103		Transistor tester		$9.40
HE104	$3.90	A.M. tuner	MAY 81	$7.50
HE105	$3.90	Basic amplifier	MAY 81	$9.50
HE106	$3.90	F.M. radio microphone	MAY 81	$8.50
HE107	$3.90	Electronic dice	JUN 81	$5.95
HE108	$3.90	Power supply		$11.95
HE110		Unmistakabell		$6.90
HE111		Ohmeter		$19.90
HE112	$3.20	Micromixer		$11.90
HE113	$3.50	Water alarm		$9.45
HE114	$3.90	Digital counter	OCT 81	$14.50
HE115	$2.90	Reaction timer		
HE116	$3.90			
HE117	$3.90	House and car alarm		$16.90
HE121	$2.90	Scratch and hiss filter		$9.00
HE122				
HE123	$4.50	Alien invaders		
HE126	$3.50	Nicad charger	(P/Pack ex $9.95)	
HE127		Siren		$3.90
HE128		Fog horn		
HE129	$3.50	Simple tuner		

YOU DON'T HAVE TO PAY MORE $$$$$ FOR A ROD IRVING ELECTRONICS KIT.

REVISED DEC. 83. **PLEASE RING FOR LATEST COMPUTER UPDATE ON AVAILABILITY AND PRICING.**

KITS
ETI 690 Little Big Board
ETI 671 Parr print interface
ETI 672 Teletype print int.
ETI 166 Fun/pul gene
ETI 175 20MHz Freq, LCD
ETI 412 LED Prog. Disp.
EA 83VE10 Vid/enhancer
EA 83SS9 Speed Sentry
EA 83MD9 Nail finder
EA 83TV7 Pattern generator
EA 83MA11 Parabolic mic
EA 83EG9 Chase "N" chomp
EA 83PS12 VK Powermate
EA 83RC12 A&B IR remote dimmer
EA 84WS1 A&B Sprinkler control
EA 83KWH12 Energy monitor
ETI 674 Microbee joystick int
ETI 658 RS232 Breakout box
ETI 1502 Sling psychrometer
ETI 1518 Video enhancers
ETI 673 Multiprom interface
ETI 272 LED power indicator
ETI 1514 A Non zero crossing *
ETI 1514 B Zero crossing *
* = **Solid State Relays**
Infrared remote control
83RC12A Receiver
83RC12B Transmitter
Energy Monitor

ROD IRVING ELECTRONICS

425 High St., Northcote, Vic. 48-50 A'Beckett St., Melb., Vic.
Phone (03) 489 8866, (03) 489 8131, Mail Order Hotline (03) 481 1436
Mail orders to P.O. Box 235 Northcote 3070 Vic.
City Store: Phone No. 347-9251

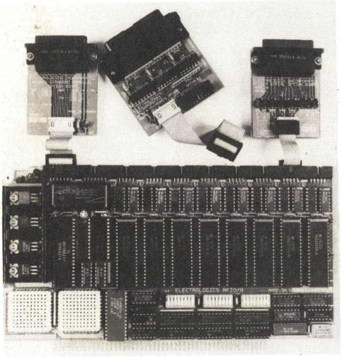
Minimum P & P $3.00. Errors & omissions excepted.
Please address tax exempt, school, wholesale and dealer enquiries

RITRONICS WHOLESALE

1st floor 425 High St. Northcote 3070 (03) 489 7099 (03) 481 1923
Telex AA 38897

AT ALL TIMES SUBJECT TO COMPONENT AVAILABILITY.

BUY DIRECT FROM THE KIT PEOPLE.
SAVE! SAVE! SAVE! SAVE! BUY DIRECT.



S100 I/O BOARD

The MF10 I/O Board is now available through Lamron, who claim that this is the most powerful S-100 single I/O board on the market.

The MF10 conforms to IEEE S100-696 standards and has such features as eight asynchronous serial ports, two eight-bit bi-directional parallel ports, internal baud rate generators, data rates to 57.6 Kbaud and programmable wait states for fast systems.

An eight-level programmable interrupt controller, together with a battery backed-up real time clock, provide features which traditionally require three or more boards.

The MF10 allows direct connection to modems, printers, terminals and other parallel or serial devices and special option boards which eliminate the need for custom cables and wiring are available.

The MF10 is only available assembled and tested, and is supplied complete with an extensive 240-page manual, source listings for a standard C/PM BIOS, interrupt driven BIOS, clock routines and initialization routines.

For further information, contact **Lamron Pty Ltd, PO Box 438, Ryde NSW 2112. (02)85-6228.**

INTEL TO DEVELOP UNIX SYSTEM V FOR 286

Intel Corporation and Western Electric are to jointly develop a part of the UNIX System V operating system for the Intel iAPX 286 microprocessor.

Western Electric has announced similar UNIX system development arrangements with Motorola and National Semiconductor.

"Standardisation is the key to delivering the full potential of microprocessor technology," said David L. House, general manager of Intel's Microcomputer Group.

"We believe UNIX System V will also evolve as one of the standards for microprocessor-based systems, and putting UNIX System V on our iAPX 286 processor will meet the needs of this emerging market-place."

XENIX FOR IBM CS 9000

Microsoft has announced that IBM Instruments intends to provide the Xenix operating system for their CS 9000 microcomputer.

Xenix is Microsoft's licensed version of AT & T's Unix operating system. It is designed to provide multi-user, multi-tasking capability for high performance microcomputers.

Other manufacturers who have announced support for Xenix include Apple, for the Lisa, and Radio Shack, for their Model 16.

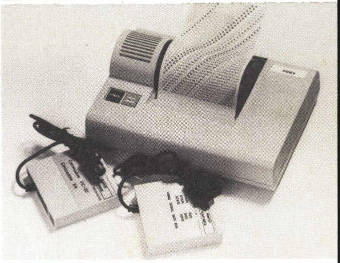
IBM Instruments CS 9000 is based on the 68000 microprocessor from Motorola and is targeted at the engineering/ scientific community.

The CS 9000 is a modular computer system that permits the user to tailor it to a specific scientific analysis, instrument control, or automated, integrated laboratory application.

"With the announcement of Xenix support for this product, IBM has demonstrated the broad acceptance of the Xenix operating system in the engineering and scientific environment as well as the business environment," said Steve Ballmer, Vice President of marketing at Microsoft, USA.

According to documents released by IBM, Xenix provides as standard features development tools such as "C" compiler, a sophisticated text processing system, multi-user support with storage protection, and programs to compare, sort, merge, scan and translate files.

For further information, contact **Microsoft, P.O. Box 98, Terrey Hills NSW 2064. (02)450-2522.**



NEW THERMAL PRINTER

A new thermal, 40-column computer printer capable of graphics has been released in Australia by Oscwell International.

An ideal WP drafting printer, the Pony thermal printer is available with RS232 and Centronics interfaces, as well as specialist Atari and Commodore interfaces.

The print control electronics are contained in the printer housing, and all interface control and character generation is contained within the plug-in interface module.

It operates at a speed of two lines per second, with 40 characters per line and it can produce good quality 320 x n dot graphics that are ideal for boardroom presentations or classroom visuals. The character matrix and specific character sets are determined by the plug-in interface module.

The Pony printer sells for $166 (sales tax included). Prices range between $20 and $40 for the interfaces.

Further information can be obtained from **Oscwell International Australia Pty Ltd, 271 Blackburn Rd, Mt Waverley Vic 3149 (03)233-3716.**

AUSTRALIAN SOFTWARE GOES TO US

An Australian-developed communications interface card, which enables the Apple Computer user to communicate with virtually any IBM mainframe, was launched in the USA at the Comdex exhibition in Las Vegas, in November '83.

Local microcomputer researcher, NetComm, developed the interface card and announced in May 1983 that it had signed an agreement with Apple Computer, giving Apple worldwide marketing and distribution rights for the card.

NetComm currently has two designs available for both the Apple NC20 and Apple NC22 computers. They communicate with IBM mainframes in 2780-3780 file to file transfer mode or 3270 on line VDU emulation. The 2780 facility also permits the transfer of files of information between other remote or local Apple computers, and any other mainframe that supports 2780-3780.

In conjunction with another local research unit, Datasat, NetComm has developed a new synchronous or asynchronous modem card for the Apple NC20 and NC22. This card will be mounted internally in the Apple's expansion slot and offers 300, 1200 and 1200/75 baud complying with Australian, UK and Europe and US standards.

This modem has auto dial, auto answer and auto disconnect features and is speed and mode selectable. Thus one internal modem will connect to asynchronous computers (DEC, Prime, Wang and database services such as CSA, GEIS, Source, MIDAS etc.), synchronous computers (IBM, ICL, Burroughs) and the recently announced Prestel service (Telecom, Cybertel, Viewdata etc).

NetComm's communications card range has been supplemented with NC23, a card designed for SNA/SDLC with a faster on-board processor (Z8) plus bigger RAM (24K) and a lower IC count.

Thus NetComm now have available the hardware cards, the telephone interfaces and the software emulations for connection to asynchronous, bisynchronous, SDLC and Prestel networks.

Further details on NetComm products are available from **Chris Howells, NetComm, Suite 8, 33 Ryde Road, Pymble NSW 2073. (02)498-5577.**

LOCALLY DESIGNED VIDEO TERMINAL

Appropriately named 'The Squatter', this locally designed video terminal with powerful emulation facilities is designed to replace overpriced and poorly supported imported terminals.

The terminal is designed and manufactured by CK Systeme and costs under $2000 in one-off quantities.

Emulations currently available on 'The Squatter' include Hazeltine Esprit II, ADM 3A and Regent 25, although a wide range of emulations (including IBM) are available on OEM quantity request.

Three screen formats are available. Baud rates from 50 to 38,400 are user selectable. The terminal has a screen based, user modifiable translation table of the control codes, enabling quick and easy modification for a given installation or replacement by another terminal.

Further facilities include: hard copy output via a Centronic type port; edit mode; full and half duplex; selective scroll and delete function; alpha graphics with vector drawing; RS232C; RS422A and RS423A outputs; and 4K of user ROM.

For further details contact **J.C. & J.P. Cens Pty Ltd, P.O. Box 122, St. Peters NSW. (02)517-1275.**

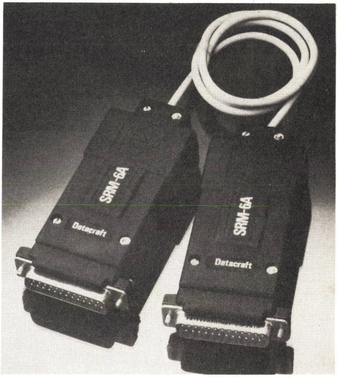
COMPUTER INFORMATION/ MESSAGE CENTRE

Paris Radio Electronics has introduced a remote computer information and message service.

This service will allow any computer user who has access to a computer with a terminal/ communications program, acoustic coupler and a telephone, to access information related to the TRS-80 Color Computer range of products. This information includes descriptions of current and soon to be released software and hardware.

Users may also send messages via the system to Tandy Computer with questions or information they may have.

For further information contact **Jacky Cockinos, Paris Radio Electronics, 165 Bunnerong Rd, Kingsford NSW. (02)344-9111.**



THE RAD FAMILY EXPANDS

Distributed by Datacraft and similar in size to a standard D type, 25 pin connector, these ultra miniature short haul modems are a full duplex, four wire data set.

There are now three members in the RAD-6 family: SRM-6D Async 0-19.2 kbps up to 35 km, SRM-6A Async 0-19.2 Kbps up to 20 km transformer isolated and SRM-6S Sync 1200-9600 Kbps up to 33 km transformer isolated.

Requiring no external power, these low cost modems plug directly into the interface socket and are powered from the transmit data lead — even if the terminal is dumb (no RTS and no DTR). They will generate both positive and negative signals in accordance with RS232 (V.24) standard, even when Transmit Data is constantly Mark or constantly Space. High common mode rejection ratio is provided by transmitting balanced voltages and receiving through balanced impedances.

Cost of the units is approximately $150 for the SRM-6D up to $350 for the SRM-6S.

For further information, contact **Adrian Wescott, Datacraft (Aust.) Pty Ltd, P.O. Box 353, Croydon Vic 3136. (03)726-9911.**

THE SECOND PERSONAL COMPUTER SHOW

The Second Australian Personal Computer Show is a complete sell-out, with exhibitors confirming space months prior to its opening in March 1984 at Sydney's Centrepoint, according to its organisers, Australian Exhibition Services.

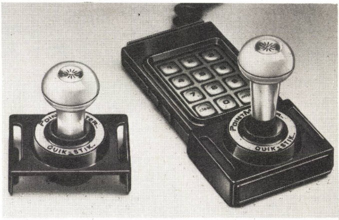
The main feature of the show will be the staging of four spectacular audio-visual presentations every hour during the four days of the exhibition.

Each has been designed to provide visitors with information on how to use the show constructively and will provide a practical understanding of the commercial benefits that can be derived from the new microcomputer technology.

There will be four separate topics covered, during each showing: 'How to use the Exhibition'; 'Hard Decision' — decisions to consider when choosing hardware; 'Soft Options' — outlining the various options for software; 'Education' — aimed at the use of microcomputers in education. The presentations will be directed toward businessmen, serious personal computer users and educationalists.

Following each session, there will be time for practical demonstrations, using a wide selection of hardware and software. Coopers & Lybrand, who will be producing the audio-visuals, will have their own company microcomputer specialists on hand to answer business questions.

Due to the overwhelming demand this year, the show has been extended to four days. It will take place in the exhibition area of Centrepoint in Sydney from March 14-17 1984. However, the first day is a 'business-only' day.



▲

VIDEO GAME CONTROLLERS

Discwasher has released several new video game control adaptors that the American company claims will sharpen the scoring skills of many players.

The new adaptors, the Pointmaster Quik-Stik I and Quik-Stik II, are compatible with Intellivision I and II respectively. Both have durable control sticks with extended handles that snap on and off the standard Intellivision controller easily to give the player better control.

For further information, contact **Arena Distributors, 642 Albany Hwy, Victoria Park WA 6100. (09)361-5422.**

68000 COMPUTER RUNS CP/M 68K

Software Australia is offering what is believed to be the first 68000 processor-computer in Australia running CP/M 68K.

The company's Manager, Dr Michael O'Shea, said that development of the 68K systems began about 18 months ago and has been under constant testing and modification up to the release date.

Dr O'Shea said the advantages of the system include; extremely high speed, massive memory capabilities, directly addressing 16 megabytes of main memory, up to 9 megabytes of memory disk available, up to 300 megabytes of fixed and/or removable hard disk storage and availability in the S-100 industry standard (IEEE-696).

The new computer will be one of the fastest micros available. It utilises a Motorola 68000 CPU running to eight or 10 MHz.

The system will be supplied standard with; 256K of memory expandable to 16 megabytes, four RS232 serial ports adjustable from 110 to 19 200 baud, or one RS232 serial and one Centronics parallel port, 24-bit address DMA floppy-disk controller, two double-sided, double-density 200 mm (8") floppy disk drives giving a total of 2.7 megabytes of formatted storage. Software for the 68K processor is relatively scarce. However, the machine can be supplied with an 8088 and an 8085 CPU or an 8086 CPU alternate processor running CP/M 80, CP/M 86 and MP/M 86 enabling a complete coverage of all programs written for CP/M or MP/M.

For further information, contact **Software Australia, (07)349-2269 or (07)349-9122.**

GRAPHICS SOFTWARE CATALOGUE

Ramtek, one of the world leaders in colour computer graphics hardware, has produced their 'Software Affiliation Catalogue'. The catalogue lists third party software packages that are compatible with the Ramtek series of computer graphic terminals and controllers.

Intelligent Systems Research (ISR), a Melbourne based firm specialising in Ramtek and the Unix operating system software, has a limited number of these catalogues available for interested parties.

The catalogue includes alphabetically listed software, software listed by major application, software indexed by host computer and software indexed by Ramtek model number.

Applications include: business/statistical, CAE/CAD/CAM, cartography/demography, FEM, general purpose, geophysics and energy related, image processing, process monitoring and control. For further information, contact **ISR, 2/969 Burke Road, Camberwell Vic. 3124. (03)82-8287.**

DISSAPPLER

In response to demand by Australian computer enthusiasts, a local computer consultancy, Latco, has developed a software package which enables the user to dissassemble (and thereby translate) 6502 object code (machine code) into source code.

Working with the DOS toolkit 6502 editor/assembler for the Apple II, Disappler enables the user to reassemble, edit or customise machine code programs.

Murray Baker, managing director of Latco, believes that the average Apple II enthusiast is at present trapped into a limited world of BASIC programming and mind destroying game software.

"The average enthusiast quickly runs out of enthusiasm when his inquisitive drive is limited in this way. Disappler will allow enthusiasts to examine operating systems, device drivers, software languages and even game software," he said.

All enquiries about Disappler should be directed to **Murray Baker, Latco Pty Ltd, PO Box 267, Cremorne Junction Sydney NSW 2090. (02)90-5462.**

APPLE SUPPORTS DEVELOPERS

A series of technical products designed to help developers create applications for Apple Computers has been announced by Apple Computer.

Called *Apple Workbench,* the product line includes development tools and technical information for hardware and software developers in the United States, but substantial flow-on s expected in light of a recent nnouncement by Apple Computer Australia that a local developer support programme is to be stepped up.

"Apple has always encourged third parties to develop applications for its computer," said David Strong, Managing Direcor of Apple Computer Australia.

"Now, through the Workench product line, we will be opening up our systems to developers even more to make hardware and software development or Apple Computers as easy nd productive as possible."

The first group of Workbench products consists of six software ackages for the Apple II and Apple III product lines:

The *DOS programmer's tool kits* provides the tools needed to program an Apple II computer in both assembly and Applesoft BASIC under DOS 3.3. Software utilities are included for developing and using special text animation character sets, as well as Boston Window, a full-screen editor.

The *ProDOS Technical Reference Manual* explains how to develop applications using the advanced features of ProDOS, Apple's new operating system for the Apple II family.

The *ProDOS Assembler Tools Package* contains the software utilities needed to program an Apple II computer in assembly language under ProDOS. The ProDOS Technical Reference Manual is recommended for use with this package.

Apple Pascal Numerics provides units that allow programmers to use single, double and extended-precision real and integer numbers in Apple Pascal for the Apple II and the Apple III.

The *Apple III Pascal tool Kit* helps programmers develop Pascal programs on an Apple III computer. It includes utilities for performing programming functions such as compiling Pascal code, comparing data text files, designing a good user interface to the program, and sorting SOS and ProDOS directories.

Pronto: The Apple III Pascal Debugger enables developers to control the execution of Apple III Pascal programs. Users can debug while executing programs at full speed, and no recompilation is necessary.

The Workbench products are for technically-skilled developers who require little or no tutorial information. Technical reference materials provided with each Workbench product are in a loose-leaf format, with separate binders available so developers can organize the reference materials to fit their individual needs. The loose-leaf format was selected to facilitate updates.

Each product is purchased separately and includes documentation. More products are scheduled to be added to the Apple Workbench series.

ROLAND MOVES INTO PERIPHERALS

The Roland Corporation is making a major move into he computer peripherals market. The company, which already holds 70 per cent of the Australian music synthesiser market, has now set up a computer division with its main arm in Melbourne.

The managing director of Roland Corporation Australia, Mr ohn Egan, said "Micro-proessor technology plays a large art in all modern electronic musical equipment. The peronal computer is about to play large part in the area of creave music.

"It is not surprising therefore, hat Roland should look to deelop a presence in computers, pecifically in the peripherals rea.

"In the past seven years we ave built up a very strong maret in the musical instruments nd professional equipment eld. We intend to do the same with our digital products."

Roland's first product in the peripherals market was the Amdek monochrome monitor, a unit recognised as one of the top-selling monitors in the US.

Roland's new computer peripherals products, now being released, are the Roland A/D/A converter, the Roland 14″ colour monitors and the Roland eight-pen and one-pen plotter range.

"Our emphasis is on quality, not volume," Mr Egan said. "We aim to supply the best value for quality products in each price bracket and to build a long-term relationship with our dealers."

Roland Corporation Australia is a local joint venture with the Roland Corporation, Japan. There are also joint venture companies in the US, Canada, UK, Scandinavia, West Germany, Benalux and Switzerland.

Roland Corporation Australia Pty Ltd is at **39 Victoria Street, Fitzroy Vic 3065. (03) 417-1800;** and at **23 Cross Street, Brookvale, NSW 2100.** (02) 938-3911.

CP/M PLUS, XENIX FOR TRS-80 MODEL 16

The Xenix multi-user operating system, developed by the MicroSoft Corporation, is to be the standard operating system on the Tandy TRS-80 Model 16 microcomputer.

A Model 16 equipped with Xenix can be expanded by the addition of up to two terminals to let three users operate programs simultaneously.

Tandy Electronics will release several multi-user applications software packages for Xenix-equipped Model 16s, including a full complement of interactive Australian modified accounting packages and a high-capacity inventory control system. Tandy will also offer MicroSoft's Multiplan package in a specially developed version that supports multi-user operation.

Xenix will operate on any Model 16 equipped with 256K of memory and a hard disk and on similarly equipped Model II or Model 12 microcomputers that have had a Model 16 upgrade kit installed.

Meanwhile, Tandy has signed an agreement with Digital Research to market and distribute the new CP/M Plus version 3.0 advanced operating system, which is compatible with the Tandy TRS-80 Model 12, Model II and Model 16 (when operating in the Z-80A mode).

CP/M Plus is a high-performance, single-user, single-task system developed for business and commercial applications, and will support about 3000 existing CP/M application programs without modification, including word-processing and financial business applications.

For further details, contact **Tandy Electronics, 91 Kurrajong Avenue, Mount Druitt NSW 2770. (02)675-1222.**

MICROPRO

MicroPro Design announces the availability of a printer exerciser which has been designed to aid retailers and distributors of RS232 or Centronics compatible printers, terminals and plotters.

Designed specifically to allow sales personnel to efficiently demonstrate the features and performance of an attached printer, it is also economical enough to find applications in the maintenance and testing of these devices as well.

The unit allows an attached printer to be driven with a standard ASCII character set or put through its paces with a custom message in EPROM. This EPROM could contain sequences to show all the features of the printer and the internal storage can give up to four typical pages of text.

The Printer Exerciser is easily set up and any configuration chosen unambiguous — a boon when setting up a printer prior to connecting it to a customer's computer.

Further details are available from **MicroPro Design Pty Ltd, PO Box 153, North Sydney, NSW 2060. (02) 438-1055.**

$180 000 GRANT FOR SOFTWARE DEVELOPMENT

The Australian Industrial Research and Development Incentives Board (AIRDIB) has approved an application for a project grant submitted by Kingdom Pty Ltd for financial assistance to research and develop a computer software process called Orion.

The grant application included a proposal for further research on this revolutionary new way of using a computer, the end result of which will be the ability to solve a wide range of numerical and logical problems without writing computer programs and to open up areas which conventional programming will never reach.

The Managing Director of Kingdom, Mr Richard Lovegrove, said that AIRDIB approved the granting of an amount representing about 50% of the project cost to Kingdom who will spend a similar amount on the research and development of the Orion system.

The potential of the system is so great that Kingdom is interested in finding a joint venture partner, perhaps with expertise in particular areas of software marketing.

Unlike programs such as 4GLs and other program generating languages, Orion does not produce a mass of third generation language code to solve a problem or develop an application.

Orion uses an altogether different organisation in the memory of the computer, and organisation tha has more similarity to a mental network than a conventional program.

The base program is written in a normal, transportable computer language and this relatively small program repeatedly operates to build up the solution from a description of the problem.

The software allows the building of models by the independent statement of known facts. The computer determines the links and relationships and, if the model is complete, produces the numeric solution.

If the model is incomplete the deficiencies are indicated. "What if" questions can then be applied at any point in the model to determine the effect on other parts of the model. Individual models can be assembled or disassembled to build larger or smaller models.

Up to now it has been necessary to write programs to enable a computer to solve problems and it was necessary for the programmer to think out the strict sequence that had to be used by the computer to achieve the solution.

In the future, using Orion, Kingdom claims a problem will be able to be described in a piecemeal fashion. The operator will only need to know a relationship between any two variables and indicate the relationship to the computer, continuing to add additional relationships as they are identified. The computer will build a model from the relationships as described. The operator will be advised when insufficient variables or relationships have been identified. By adding additional information or formulae the computer will work towards completing the construction of the model.

Kingdom is a specialised software house with concentrates on the research and development of computer programs for applied science especially engineering, architecture, surveying and information management and modelling. Kingdom computer software suites are in use in local and state government and consulting private practice in Australia, New Zealand and Singapore.

Orion is seen as a program which will have wider application than Kingdom usual computer suites and certainly represents a very significant world product.

Kingdom, P.O. Box 338,
Ryde NSW 2112. (02)807-4822.

AT & T TO UPSTAGE IBM?

American Telephone & Tele
graph is planning to intro
duce a microcomputer syste
within the next six months
according to a new research rep
ort from International Resourc
Development, a US marke
research firm.

The report predicts that th
microcomputer will use 32-bi
architecture based on Wester
Electric's Bellmac microproces
sor, and that the software will b
based upon Bell Laboratories
Unix operating system. Th
combination of the longer wor
length (32 bits, as compare
with 16 bits on the IBM Persona
Computer) and the powerfu
Unix-based software, wi
enable the new AT & T micro
computer to 'upstage' the IB
PC, according to the report.

In order to successfully ente
the microcomputer market a
this relatively late stag
AT & T will have to offer it
microcomputer users the optio
of running software develope
for the IBM Personal compute
The report predicts that th
AT & T micro will be able t
run an 'MSDOS lookalike' pro
gram which is apparently bein
secretely developed b
Microsoft.

For System 80™, TRS-80™ Model I/III and Colour Computer owners:

ONE BIG ISSUE OF MICRO-80 MAGAZINE FREE!

If you own one of these computers, you should be reading MICRO-80 magazine, the magazine not only written by enthusiasts, but actual owners and operators of the same computers you use.

MICRO-80 understands your needs, is vital reading from cover to cover and features six new programs in each issue with full operating instructions.

An analysis of each program's structure and operation is included to help you improve your own programming capabilities.

Instructional articles on programming techniques, hardware improvements and answers to readers' problems are also published each month.

ANOTHER MICRO-80 PLUS

Readers can purchase a wide range of software and hardware for their systems at keen prices.

DON'T DELAY, ACT TODAY

Either telephone your order on (08) 211 7244 (4 lines) or send in the coupon today.

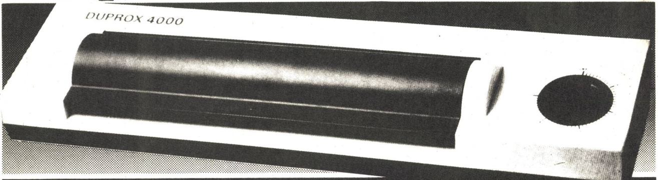
TRS-80 is a trademark of the Tandy Corporation. System 80 is a trademark of Dick Smith Electronics.

Please send me your free issue of MICRO-80 ☐
Commence my MICRO-80 subscription for 12 months. ☐
(a) Please debit my Bankcard ☐
(b) I enclose a cheque for $26.00
My computer is a: System 80 ☐ Model I ☐ Model III ☐ Colour ☐
Name ....
Address .... P/code ....
Bankcard No. ....
Exp. End ....
Signature ....

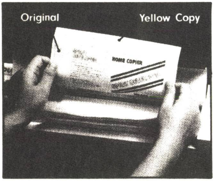
To: Micro-80
P.O. Box 213,
Goodwood,
S.A. 5034

ETI

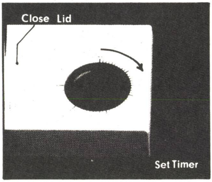
HOME COPIER



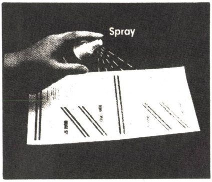
Why waste time and money running out to expensive copy shops when this Mini Home Copier can satisfy all your copying needs in the comfort of your home—for just cents! With features you'd expect in a high quality copy machine, and size small enough for any desk or table, and big enough to do the job right. A thoughtful gift that will be appreciated for years to come, save time, save money. Buy your Mini Home Copier today!



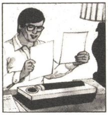
(1) Place ORIGINAL, face up (one side must be blank) on top of COPY PAPER, Yellow side up. Insert both sheets together around cylinder. Be sure face of original to be copied is next to cylinder.

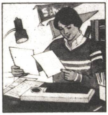


(2) Push through until sheets appear in front of cylinder and close lid of machine. SET TIMER DIAL. Light shines through original copy (for regular paper, set about two and a half mins or a bit more, and the thicker the paper, the higher the timer number).



(3) After timer shuts off, open lid, remove paper gently from machine, spray with image set developer back and forth horizontally, lightly covering entire page. A perfect copy appears in about 20 seconds. Wipe spray nozzle after application.





ONLY $99.00 (includes Home Copier, pack containing 30 sheets of paper, developer, spray bottle, instructions and 12 months warranty card).

Extra packs of paper and developer—$4.95.
Prices include postage to any address in Australia.

New Zealand Readers: Please add $20.00 to cover packing and delivery. Additional paper and developer will be available locally.
Please allow four weeks for delivery.

ELECTRONIC COMPONENTS PTY LTD
29 Wollongong Street, Fyshwick ACT 2609
telephone 804654
Postal Address
PO Box 534 Fyshwick ACT 2609

Name: ....

Address: ....

.... Postcode: ....

Signature: ....

Unsigned orders cannot be accepted.

Tick box to indicate payment
Bankcard ☐ Cheque * ☐

* Please make cheques payable to Electronic Components Pty Ltd.

Card No: ☐☐☐ ☐☐☐☐☐☐☐☐☐☐☐☐☐

Expiry date: ....

bankcard
welcome here

PHONE YOUR ORDER — ALTRONICS TOLL FREE 008·999·007

BANKCARD HOLDERS — PHONE ALTRONICS TOLL FREE 008·999·007 FOR NEXT DAY JETSERVICE DELIVERY

1984 ALTRONICS ELECTRONIC COMPONENTS CATALOGUE

YOURS FREE with this month's Electronics Australia Magazine
OR send $1 to cover P&P to Altronics, P.O. Box 8280, Stirling St., Perth, W.A. 6000

REMEMBER

Altronics staff are all keen young electronics enthusiasts — just like yourself — so when you need a little technical help, give us a call.

- ★ Quality Products at direct import prices.
- ★ Save up to 50% on our competitors prices.
- ★ Overnight delivery Australia wide.
- ★ Bankcard phone orders service to 8pm Mon-Fri.
- ★ Check some of the savings on our nearest competitors 1983 prices.

NEW STD FREE PHONE ORDER SERVICE

An Altronics 1st is our new **INWATS Toll Free Order Line.** Bankcard holders can call us from anywhere in Australia for the cost of a local call and place your order; after validating your Bankcard, **presto** the order is on its way to you in a matter of hours. Remember with our **Overnight Jetservice** we deliver next day to capital cities and suburbs and 24 - 48 hours later to country centres. So if you're not already an Altronics Customer just pick up the phone and dial 008 999 007 and we guarantee to deliver faster than your local supplier.

EXAMPLES

S1020
DPDT MINIT.
TOGGLE
$1.50

Why Pay $2.45

Z80A
CPU
$4.50

Why pay our nearest competitors $8.95

Z1174
2N3055
TO-3 POWER
TRANSISTOR
$1.30

Why pay $2.50

FOR THE VERY QUICK!

Here are some incredible bargains. We suggest you phone order now to reserve yours.

PROFESSIONAL QUALITY
SOLDER SUCKERS

Not to be compared with inferior "Hobby types". Saves countless hours in fault finding and repair of complex PCB's.

- SINGLE HANDED OPERATION
- SELF CLEANING PLUNGER
- LONG LIFE TEFLON TIP
- DOUBLE DIAPHRAGM, DUAL O-RING SEAL
- 225mm x 20mm(d) 50mm STROKE
- POWERFUL SUCTION

T1240. . only **$11.95**
T1241. Replac tip. **$1.95**

ALTRONICS

105 STIRLING ST. PERTH — FOR INSTANT SERVICE
008 999 007 TOLL FREE
(09) 328 1599 PERTH METRO AREA & AFTER HOURS RECORDED SERVICE
All Mail Orders: Box 8280, Stirling St, Perth, WA 6000.

"MICROBEE KEYBOARD"

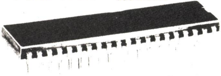
Full 60 Key Qwerty Computer Keyboard exactly the same type as has been used up to now with the famous Microbee Computer. SPST keys. Complete with mounting plate, all key caps etc. Fully assembled. Incredible value — Be Quick!

D1510.................... **$29.95**

Microbee is registered trademark of Applied Technology Pty. Ltd.

HALF PRICE Z80 A

FULL SPEC FAMOUS SGS BRAND



Z9001 CPU ~~WAS $8.95~~ NOW **$4.50**
Z9005 PIO ~~WAS $8.95~~ NOW **$4.50**

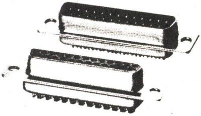
DE-SOLDER BRAID

HALF PRICE

T1230.................................$1

HUGE IMPORT PURCHASE SCOOP D RANGE COMPUTER CONNECTORS QUALITY GOLD PLATED PINS

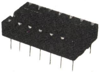
MASSIVE SAVINGS



	ea.	10 +	25 +
P 0880 DB9 Male 9 Pin	2.20	1.95	1.80
P 0881 DB9 Female 9 Pin	2.70	2.50	2.00
P 0885 DB9 Backshell	2.50	2.30	2.00
P 0890 DB15 Male 15 Pin	2.50	2.29	2.00
P 0891 DB15 Female 15 Pin	3.00	2.80	2.30
P 0895 DB15 Backshell	2.50	2.30	2.00
P 0900 DB25 Male 25 Pin	3.95	3.60	3.00
P 0901 DB25 Female 25 Pin	4.50	3.98	3.50
P 0905 DB25 Backshell	2.50	2.30	2.00

IC SOCKETS DIL

LOW PROFILE



SAVE A FORTUNE

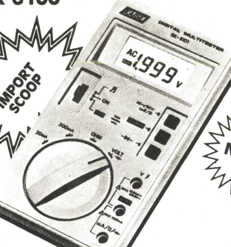
	ea.	10 +	25 +
P 0550 8 Pin	.18	.15	.10
P 0560 14 Pin	.20	.18	.15
P 0565 16 Pin	.20	.18	.15
P 0567 18 Pin	.30	.25	.20
P 0570 24 Pin	.45	.40	.35
P 0575 40 Pin	.65	.55	.45

PHONE YOUR ORDER — ALTRONICS TOLL FREE 008·999·007

PHONE YOUR ORDER — ALTRONICS TOLL FREE 008·999·007

KAISE DIGITAL MULTIMETER SK 6100

IMPORT SCOOP



NEW

WAS
$89.95

Now $59.95
Cat Q1100

Check the specifications/features of this superb Digital Multimeter. **Autoranging** with manual override **Auto Polarity** displays — sign when probes reversed **overange indication** "Blink" and Buzzer warning **Low Battery Warning** BATT Sign shows. **Sampling Rate** 2 times SEC **Power Supply** 2 x A penlight batteries (300 hour continuous operation). **Fuse Protected,** spare fuse provided. **Zero Adjustment,** zero adjust button — a must if you change test probes. **LCD Display,** magnificent clear readout. **Inbuilt Buzzer,** available for continuity test, overload warning and switch warning. **Ranges** + / – 1000 V DC/600 V AC, AC and DC current, resistance 200 (Resolution .1 OHM) to 2000K OHM (resolution 1K OHM) in 5 ranges autoranging. **ACCURACY** ·5% DC, ·8% AC.

NEW MODEL DATA CASSETTE

UNCONDITIONALLY GUARANTEED TO SAVE/LOAD THE RAWEST OF DATA EVERYTIME!

Unit shown has extra key

D1122... **$49.50**

A recorder designed solely for the purposes of data storage now at an unbelievable price

- ★ SLIDE VOLUME CONTROL **a must** for quick checking of levels.
- ★ TAPE COUNTER **a must** for easy location of programmes.
- ★ INBUILT PIEZO TRANSDUCER **enables** you to listen audibly to tape.
- ★ 6v DC operation - USE WITH M9000 PLUG PACK **ensures** low hum levels.
- ★ ROBUST CONSTRUCTION OF BOTH INTERNAL MECHANISM'S AND EXTERNAL CASE.
- ★ LONG LIFE ALKALINE BATTERY SUPPLIED (4 x AA CELLS)

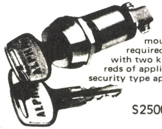
C20 DATA CASSETTES

Quality MICRON brand.

D1141 .... **$1.50** (10 UP) **$1.25**

KEY OPERATED SWITCH

HALF PRICE! BE QUICK, 500 ONLY.



19.5mm mounting hole required. Supplied with two keys. Hundreds of applications for security type applications.

S2500 **$3.50**

WEATHERPROOF SIREN HORN

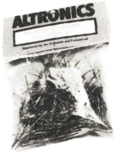
12V DC operated — Deafening Siren Wail. Super handy for audio signalling, secruity systems etc. Current drain 500MA approx. Completely weatherproof. Attractive off-white PVC finish.

S 5058 . . . ~~$19.50~~ NOW $15.00 ea.
STREWTH!

MINI SPEAKER 57mm

Large Ferrite Magnet. Ideal replacement speaker. Great for hobby projects.

C 0610... ~~$1.95~~
Now $1.25 ea.



INCREDIBLE VALUE BULK PACKS

ALL COMPUTER SELECTED

SUPER PRICE

$5 each

R3501..........25W Resistor Pack
Av. contents 300.................. $12 Value

R3510.......Greencap Pack 100V
Av. contents 50.................. $12 Value

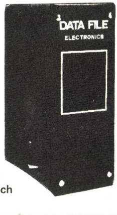
R3515.........CERAMIC PACK 50V
Av. contents 100.................. $14 Value

R3520. ELECTROLYTIC PK. PCB TYPE
Av. contents 40.................. $14 Value

VINYL BINDER

Holds 12 magazines, each on a spring out wire rod. Just the shot for each year's set of Electronics Australia, ETI or any of your favourite magazine.

Suits all A4 size publications (275 x 210). Very smart Royal Blue colour with beautiful gold embossing.



B 9999 . . . ~~$5.50~~
THIS MONTH
$5.00 each
4 or more $4.50 each

MINI TOGGLE SWITCHES

OEM QUALITY 250V 2 AMP RATED

6mm mounting hole
12mm x 12.7mm x 20mm (D)

	ea.	10 +	25 +
S1010 SPDT	**$1.25**	**$1.10**	**.95**
S1025 SPDT C/OFF	**$1.50**	**$1.25**	**$1.10**
S1020 DPDT	**$1.50**	**$1.25**	**$1.10**
S1030 DPDT C/OFF	**$1.95**	**$1.75**	**$1.50**

MINI BUZZER 5-15V DC

Handy little solid-state audio "Buzzer" or signalling device. Just the shot for communicator panels, or for timer alarms or in the car. Polarity conscious.

½ PRICE S 5062 . . . **$1.00**

OOPS WE MADE A BOO BOO!

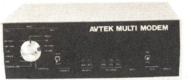
Right now we have around ½ million Premium Quality Genuine Philips IN914/IN4148 Signal Diodes — Out they go at never to be repeated prices.

	1's	100's	1000's
Z0101..........	**4c**	**3c**	**2c**

PHONE YOUR ORDER - - ALTRONICS TOLL FREE 008·999·007

BANKCARD HOLDERS — PHONE ALTRONICS TOLL FREE 008·999·007 FOR NEXT DAY JETSERVICE DELIVERY

AVTEK MULTI MODEM



SEE EA JAN. 1984

THIS KIT WILL 'KILL' ALL OTHER KITS AVAILABLE IN ITS TOTAL COMMUNICATION WITH THE WORLD . . . READ ON

Modulation - Frequency shift keying: Digital Interface - RSC-232C: Auto answer and disconnect: Data communicatin to basic Bell or CCITT specifications giving a world data communications capability: Operates with your normal phone: 300BPS or 1200BPS with backward channel 75BPS: Indicators and test switch: Auto answer or manual connect: Backward channel standard on 1200BPS mode: Direct connection, inbuilt line isolation unit. Operates in the following modes:- Bell 103 originate 300BPS, Bell 103 answer 300BPS, Bell 202 equalised 1200 BPS, Bell 202 1200BPS, CCITT V23 mode 2 equalised 1200BPS, CCITT V23 mode 2 1200BPS, CCITT V21 originate 300BPS and CCITT V21 answer 300BPS.

ONLY $229

BOOK BARGAINS

BASIC WITH STYLE "Programmers can and should write programs that work correctly the first time". This statement may sound idealistic to those accustomed to long hours of debugging. Yet it's the theme of Henry F. Ledgard's series of programming style guides. The latest book is intended for BASIC programmers who want to write carefully constructed, readable programs. A special chapter shows you how to use the top-down approach with BASIC. The guide introduces superior methods of program design and construction in BASIC.

$4.95

PASCAL WITH STYLE You'll find many samples pf PASCAL programs that have been thoroughly read and criticized, so you can be sure that they are among the most readable programs seen anywhere today. A special chapter shows you how to use the top-down approach with PASCAL.

Written by Henry F. Ledgard, Paul Nagin, and John F. Hueras.

$4.95

COMPUTERS IN ACTION second edition What do banks, airlines, hospitals, the police, and utility companies have in common? They all have made computers a vital part of their daily routine. And now you can understand the vital part that computers play in our society.

The book answers the questions: "What are computers?" "How do computers work?" and "What can a computer do?" New features in this second edition include: microcomputers and microprocessors; memory devices such as floppy disks; new input/output units such as COM units; and a section on structured programming, the APL language, and the RPG language.

Written by Donald D. Spencer this book contains many photo's, illustrations, diagrams and cartoons.

$5.95

HOW TO BUILD A COMPUTER CONTROLLED ROBOT

The dream of robotics, to create an intelligence other than human, is fast becoming reality with the availability of microprocessors. The book details the step-by-step directions for building a computer-controlled robot, named "Mike". Every step is explained with complete control programs clearly written out. Photographs, diagrams, and tables help to direct you in the construction. You may use the directions exactly as they are set forth in the book or as a basis for developing your own design.

$7.95

FORTRAN FUNDAMENTALS - A SHORT COURSE Beginning programmers will find this text a fast and efficient guide to the fundamentals of FORTRAN. The main objectives of the text are to provide an abbreviated means of learning the language, to make students familiar with their language manuals, and to instill a realization of the power and usefulness of FORTRAN.

Eleven sample programs are provided, along with complete solutions, although students are consistently encouraged to try various routines and to analyze their success or failure.

$3.95

THE JOY OF MINIS AND MICROS Here's a collection of articles from ***Computer Decisions*** covering the use of small computers for business. The book cuts through the advertising hype put out by vendors and manufacturers to enable the businessman to answer questions such as whether a small computer should be used for a particular job, how to go about choosing the right system, and how to purchase and install it.

$5.95

USING MICROCOMPUTERS IN BUSINESS Written by a consultant to owners of small businesses, this book is an essential background briefing for any purchaser of microcomputer systems or software. It describes the advantages and disadvantages of computerization and gives the potential user the information necessary to make intelligent decisions.

$6.95

DON'T PAY U.S. PRICES + 50% FOR BOOKS
BUY FROM AVTEK AND *SAVE* UP TO 50% OFF U.S. COVER PRICE

"D" CONNECTORS

Pins	Type	IDC		Solder		R/Angle	
		1-9	10«	1-9	10«	1-9	10«
9	Male	$8.50	$8.00	$2.50	$2.20	$6.50	$6.00
9	Female	$8.95	$8.25	$2.95	$2.70	$7.50	$7.00
15	Male	$9.95	$9.00	$2.95	$2.50	$6.50	$6.00
15	Female	$10.95	$10.00	$3.50	$3.00	$7.50	$7.00
25	Male	$11.95	$11.00	$4.50	$3.95	$9.95	$9.00
25	Female	$12.95	$12.00	$4.95	$4.50	$10.95	$10.00
37	Male	$15.95	$15.00	-	-	-	-
37	Female	$16.95	$16.00	-	-	-	-
50	Male	$20.95	$19.95	$9.95	$9.00	-	-
50	Female	$22.95	$21.95	$10.95	$10.00	-	-

"D" COVERS

9 pin	$2.50	$2.20
15 pin	$2.50	$2.20
25 pin	$2.50	$2.20
50 pin	$5.50	$5.00

We also stock a HIGH QUALITY 25 pin Cover complete with mounting screws for semi-permanent mounting - $5.50 (1-9) or $4.95 (10«)

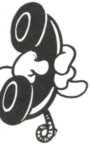
SPECIAL DISCOUNT ON XLR CONNECTORS (Cannon Type)

TYPE	Normally	NOW
3 PIN LINE MALE	$3.50	$2.80
3 PIN LINE FEMALE	$3.50	$2.80
3 PIN CHASSIS MALE	$3.20	$2.56
3 PIN CHASSIS FEMALE	$3.50	$2.80
5 PIN LINE MALE	$6.50	$5.20
5 PIN LINE FEMALE	$7.50	$7.00
5 PIN CHASSIS MALE	$5.50	$5.00
5 PIN CHASSIS FEMALE	$6.50	$6.00

ROBOTICS MOTOR - IN STOCK!

24 Volt but runs perfectly on 12 volts DC.
Output speed @ 12V approx. 40 rpm.
Current drain @ 12V No Load approx. 100mA. Stalled current approx. 200mA.
Size: Overall 55mm long by 35mm wide.
Shaft length 20mm and shaft diameter approx. 4mm.

MADE BY CANNON OF JAPAN
ABOUT 30% OF NORMAL PRICE
SAVE - BUY 4 UNITS FOR $35 OR
ONLY **$9.99 EACH**



AVTEK
(ELECTRONICS) Pty. Ltd.

TWO GREAT LOCATIONS
119 YORK STREET, SYDNEY 2000
PHONE: (02) 267 8777
(Above Charlie Browns Place)
172 LIVERPOOL ROAD (HUME HIGHWAY), ENFIELD
PHONE: (02) 745 2122
All Correspondence to:
P.O. BOX Q302, QUEEN VICTORIA BUILDING,
SYDNEY 2000

bankcard

POST AND PACKING

Divide the value of your order by 20 (5%) to get post and packing value and then add $2.00 – it's that simple!

All Bankcard orders can only be sent to a normal address (NOT a P.O. Box). All Bankcard orders will be sent by registered mail (add $3 to P&P charges).

ENFIELD OPEN ON SUNDAY

The Sphere MkII computer reviewed

This computer is designed for the small expanding business ather than the home computer market. This article looks ritically at its hardware and software.

Jonathan Scott

HE SPHERE MkII computer is a small usiness machine, not a home computer or recreational piece of electronics. It is ncased in heavy duty aluminium and sports wo slimline 5¼″ double density single-sided loppy disk drives.

A pair of momentary switches for hard eset and abort are on the front panel; the ard reset switch is particularly annoying ecause the red LED identifying it flashes ontinuously.

When reset, control is returned to the onitor, which initialises itself. This will be iscussed shortly. The abort function returns control to the monitor, but outputs the urrent processor registers. It then returns the control entry level of the monitor ithout severe interference to the RAM.

There is also a set of LEDs indicating I/O ctivity. The rear panel contains the power witch, a cooling fan and a number of plates esigned to allow the installation of boards ith connectors for interface cables.

The unit supplied to us for review had the rocessor board, a 6809 system with monior, and 56K of RAM with interfacing for e terminal supplied. This, with the two rives internal to the system, is the recomended minimum system. Expansion of emory is possible, as is the connection of erial and parallel ports, disk controllers, tc.

The terminal which we received, a CCT-00, is a separate component to the comput-r. It is a substantially unintelligent unit, all processing power being vested in the main control box's 6809.

The CCT-100 consists of a neat enclosure, barely larger than the tube it contained, and a separate keyboard connected by a coiled cable. The protocol setting switches are accessible from the rear, below the rounded protrusion enveloping the CRT.

The whole package is very trim, and the keyboard is low and fairly ergonomically laid out. The screen is a green raster type with pleasant characters. The only possible complaint might be the strong background illumination which did not vary with the character brightness control. This does not, however, impair operation or cause any significant strain on the operator that we could perceive.

In line with the large scale type of machines used in business applications, the only firmware (software permanently stored in ROM) is a monitor. If you have seen the original 6800 microprocessor monitors, you have effectively seen the one supplied in this system. It has the usual crude memory examination and modification functions, but to the pure business user who is not developing any low level software for himself, these functions are of no concern.

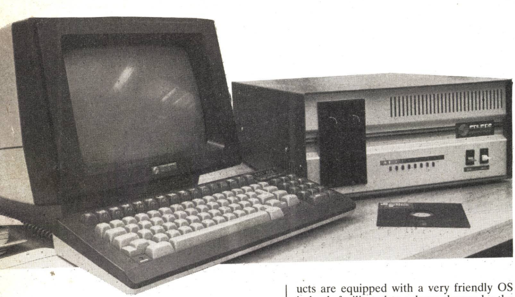
Booting the DOS

We were surprised that this old sort of monitor was supplied because a command is required to cause the booting of the disk operating system (DOS). 'Booting' is a term used to describe the starting of a disk-based operating system. Although the hardware manual indicated that automatic booting was possible, no amount of coaxing would produce this on our unit.

Typing a 'u' causes booting for internal minifloppies, while more recent computer designs automatically search out all mass storage units (disk drives etc.), and load the DOS from wherever it is first located.

This is the first hint of the Sphere's major failure — it is rather old fashioned in its architecture, in that it does not follow modern trends to make computers more 'friendly' by minimising keystrokes and reducing the amount of effort required from the user. Since there is a method of entering the monitor already incorporated in the DOS, the original boot command is only a nuisance.

The operating system is called Flex. It is a standard 6809 system, related to OS9. Flex strongly resembles the kind of operating system (OS) found on large mainframe computers. It has a powerful set of commands with which one could have little complaint on grounds of technical inadequacy. However, the user should expect to take some time to become familiar with them because of their complexity. ▶



Vesting all processing powers in a single station, which communicates only via unintelligent terminals, is another shortcoming in the design. In more recent business systems, the OS either presents menus for command selection, or offers a 'help' facility of some kind on at least some of the commands.

In addition the commands, though powerful, assume a certain knowledge of the system and a basic familiarity with computer nomenclature. This frequently occurs in designs where unintelligent terminals share resources.

Flex is, not surprisingly, very flexible. It has a distinct leaning toward, and provision for, the user who will develop his own software.

It is also very well documented, with a degree of care and detail not found in the down-market domestic computers. The documentation has been progressively refined with each version of the OS. We were supplied with two manuals for the Flex, and documentation was right up to scratch on the additional features incorporated in one of them.

It was a seemingly bad decision to arrange the computer as a discrete CPU box with a standard unintelligent terminal. This prevents the incorporation of special function keys with screen labels, and all those ergonomic facilities such as partitioned screen lines and separate screen areas for separate task levels.

It has the dubious advantage of freeing the manufacturer from the need to build a CRT and keyboard, but this would seem to be a small gain for a large loss. Because a large computer is expected to communicate with large numbers of users at once this structure can be justified, since each user only needs a standard terminal interface. However, the Sphere isn't really up to multi-user operation.

Although it is being sold as 'an 8-bit machine offering the processing power of 16-bits at an 8-bit price', a single-user 16-bit computer is no news these days, and the latest machines offer 16/32 or full 32-bit power, dedicated to one user. Such products are equipped with a very friendly OS indeed, facilitated to a large degree by the permanent mating of the output device with the keyboard and CPU, and the use of a customised OS, rather than a standard OS such as Flex.

Expansion

On the hardware side, the Sphere is quite robustly constructed. Its case is heavy duty anodised aluminium. There is plenty of room for expansion, both on the motherboard's main buss and on the I/O 'slots' behind the rear plate.

We were a little disappointed to see that the connections to the motherboard were the cheaper pin-and-socket arrangement, rather than gold-plated edge connectors which are standard in a lot of up-market machines and some domestic machines. This connection scheme was popular a few years ago, which reinforced our opinion that the machine is very much based on traditional lines.

All memory and VLSI chips were mounted in sockets. The pc boards are not cramped and this no doubt enhances reliability. The hardware documentation is excellent. A bound manual is supplied which contains the circuits and layouts, as well as descriptions of the relevant concerns such as environments, etc.

The Sphere is targeted at the small expanding business that cannot justify the purchase of a large system, but which needs to be able to expand beyond the initial configuration, and have access to a lot of software. A 'home' type computer is inadequate in many respects for such an application.

Software

A considerable range of software is available for the Sphere because it is a standard configuration of a 6809, which is source-code compatible with the original 6800, the first microprocessor ever built. We were supplied with a sample of the programs. We will discuss the Extended BASIC and the editor in a moment.

Other software available includes PASCAL and C compilers, Forth, assemblers, cross assemblers for most 8-bit micros and for the 68000, as well as the usual word processors, spreadsheet programs spelling aids and COBOL compilers.

I can't comment on the quality of the software offered by the local agents as I haven't seen any of these operating. These high level programs will probably be of a quality similar to the OS and the two programs mentioned below. The C compiler was described as being a fast 6809 specific program, so it will be more recent and hopefully more efficient.

The extended BASIC is very much in the same vein as the rest of the system, ie: it is fairly complete, but has none of the more clever commands and facilities which have appeared recently. Unusual extensions of BASIC have made it into a much more powerful language than was originally intended. This version has the capability to crudely overlay program sections, trap errors, and has such commands as a 'print using' and a 'pass to DOS (+)' function. It can also partially compile sections of BASIC code.

The editor

The editor is also a very old fashione arrangement and is, as such, fairly unfriendly. Amongst the software offered is what i termed a 'full screen editor', but it is no explained whether it is an on-screen edito in the usual interactive sense.

If you were doing a lot of developmen rather than some occasional updating, th editor would become a little tiresome Nevertheless it seems to offer all the necessary facilities for getting the job done. received no manual for this utility but familiarity with editors in general allowe me to sort out its method of interfacing – an advantage of having a very conventiona program.

Well now, let us get down to prices. Th terminal sells for $799 and the Sphere CPU box for $3500, which presumably include only the DOS. An idea of software price can be gained from a few examples: the extended BASIC is $110, Flex is $175, a editor/assembler is $110, XForth is $175, word processor is typically $350, and spreadsheet program is typically $465. parallel interface is $135 (suitable for driving a printer), while a modem interface $180 including the software to run it.

A separate enclosure with two eight inc floppies and a controller, which will be abl to handle a Winchester disk and a streamin tape drive (when available) sells for $350 (Prices are without sales tax where applicable.) There is also a software update facilit offered for those interested, at a nomin cost of $25 per year.

At these prices, a buyer would have put a lot of value on having a system wit extensive software backup to justify th expense. Similar terminals to the one w had can be purchased for less than $799 several places. There are plenty of manufacturers of machines with similar softwa followings which are more recent in desig style. In short, unless you have a need maintain 6800 source-code up compa ibility, I cannot recommend the Sphe MkII as good value or solid technical sens at its price.

K-NAR FEBRUARY SPECIALS

Start your own system with an SD Systems MPB-100, Z-80 CPU card (4MHz, 2K Eprom, front panel i/face). Unbelievable value.	**$125**
2708/16K Eprom cards-switch selectable for 8K, full address decodable. Unbeatable value.	**$40**
Turn your Olympia ES-100 typewriter into WP printer and full duplex terminal. Never before value	**$180**
Steal of the year! 5¼″ disk drives. Secondhand, in full working order. (5 only). Full cost	**$220**

OTHER S-100 CARDS AVAILABLE AT OUR NORMAL KEEN DISCOUNTS...

GDC-512 High-RES Graphics Card. Unbeatable value and features	**$450**
CMC-10 Color Graphics Palette Card	
SBC-800 Single Board Computer	**$415**
FDC-II Enhanced Floppy Disk Controller	**$389**
CRC-64 64K CMOS RAM card	**$593**
DRC-II 64K Dynamic Ram card	**$593**
MPU-100 10-slot bench-mount card cage	**$450**
(with boards)	**$3600**
DDU-8 Twin 8″ drive unit (2MB)	**$1660**
MPC-6 Multi-channel I/O card	**$450**
ADC-32 32 channel A/D card	**$337**

All boards assembled and tested and backed with 90-day guarantee.

All unbeatable value from

K-NAR COMPUTER CARDS

PO Box 412, Dandenong 3175. Phone (03) 795 5858.
Authorised distributor of SME Systems products.

*Limited time offer only.
For retail prices add 20% tax.

K718A

Straight from the Source

No. 1 in a series

With Software Source's programme "Punctuation and Style" there's only a slim chance you'll be transformed overnight into the new Charles Dickens or, God help you, the new Harold Robbins. However the programme will – in seconds – make your letters, documents and even your novels clearer and more concise. A second programme called "The WordPlus" will actually scan your texts and pick up any spelling mistakes. Available from most computer software outlets, the Software Source programmes are on floppy discs and need to be linked to a word processor.

As the title indicates, "Punctuation and Style" can be used to find punctuation errors in your copy. Of course, the programme won't actually modify your text. "Punctuation and Style" picks up errors and makes suggestions about how they could be corrected.

If, for instance, you typed: "The contract what which I wrote . . .", the programme would swiftly and politely say that you'd just indulged in some sloppy English grammar. It would then suggest an alternative. The key to "Punctuation and Style" is its inbuilt phrase dictionary which contains about 500 most commonly misused phrases.

The phrase dictionary can also be modified by its user – eg, lawyers can make up a specific legal dictionary which can be programmed to find messy phrases.

"The WordPlus" programme has a 45,000 word dictionary.

It not only signals when it sights spelling mistakes, it can also count the number of words in a text. Other "pluses" involve a readout of the frequency of word usage . . . perhaps you're littering your copy with too many "buts" or "howevers". You can even use the programme (pssst! don't breathe a word of this) to cheat at crossword puzzles. "Punctuatuation and Style" sells for $239 retail, including tax. "The WordPlus" sells for $249 retail, including tax.

Software Source Pty Ltd Inc in NSW

P.O. Box 364, Edgecliff, NSW. 2027. Phone (02) 389 6388.

Please send me full details of your WordPlus and Punctuation and Style systems.

Name

Company

Address

ETI

AHEARN SS5

Synertek™ Incorporated **Rockwell International**

6500 PRICES SLASHED

Upgrade to 2MHz with these LOW Prices

6502A	CPU, 40 Pin, Clock, 64K	A$ 5.83
6511AQ	Single Chip Micro, CPU, RAM, etc	26.44
6541AQ	Periph. Controller, RAM, I/O Host Slave I/F	19.25
Z8-03	2801 Pin Compatible, 24 Pin Piggyback	78.62
6522A	VIA 40 Pin two bit I/O Ports	5.13
5632A	COMBO 40 Pin	6.86
6545A-1	or 6545-1PE CRT Controller	11.41
6511A	ACIA 28 Pin	7.24
6592	Single Chip Printer-Controller (for Epsom Series 200 and 500)	27.34
1791-02	FDC 40 Pin	31.80
1793-02	FDC 40 Pin	31.80
2661-1	Sync/Asyn Coms I/F 28 Pin	14.14
2128	2K x 8 RAM 120 nSec LP mode	5.52
4164	64K x 1 Dynamic RAM	7.72
2532	4K x 8 Industry Standard EPROM	6.16
QUIP64	Socket for 6511AQ and 6541AQ	1.78
CRYSTALS	1.8432MHz, 2.00MHz	2.75
	32.768KHz, 3.686MHz, 8.00MHz, 4.00MHz, 12.00MHz	1.75

Plus Sales Tax, Postage and Pack. (where applicable)

energy CONTROL

**PO Box 6502,
GOODNA 4300
Brisbane
Australia
Tel 07-288 2757
Telex AA43778 ENECON**

**3 Edgeware Rd
Wadestown
WELLINGTON
New Zealand
Tel 4-72 6462**

GET THEM WHILE THEY'RE LEGAL!!!

Ⓤ Public Domain Software Library – No Rights Reserved

Following recent clarification of copyright law, we are releasing a series of software volumes 100% compatible with current versions of leading imported packages, usually retailing for more than ten times our price.

$30 per disk!!!

(Standard 8″ SSSD – other formats $20 per volume extra). Plus 20% sales tax.

S.A.S.E. for detailed list.

"AS IS". No support and no manuals included. BUT NO RIP-OFF PRICE and FULL REFUND for return within 30 days if not COMPLETELY SATISFIED (less postage and $5 handling).

This is a non-profit public service promoting the concept of publicly funded public domain software. Further explanation on disks.

El Cheapo Computing

(03) 481 0669
301 St. Georges Rd., Nth Fitzroy 3068.

RITRONICS WHOLESALE

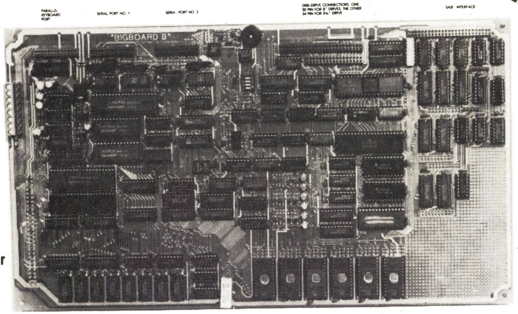
This Month Only
$695 inc. tax

START YOUR ELECTRONICS
COURSE WITH THIS PROJECT.

425 HIGH STREET NORTHCOTE 3070 MELBOURNE (03) 489-8131
48–50 A'BECKETT STREET MELBOURNE (03) 347-9251

"BIG BOARD II"

OVER 1,000
SOLD



EPROMs shown only for clarity.

STD Bus Connector

Prototyping Area

Jim Ferguson, the designer of the "Big Board" distributed by Digital Research: Computers, has produced a stunning new computer it has the following features:

4 MHz Z80 — CPU AND PERIPHERAL CHIPS

The Ferguson computer runs at 4 MHz. Its monitor code is lean, uses Mode 2 interrupts, and makes good use of the Z80-A DMA chip.

64K DYNAMIC RAM + 4K STATIC CRT RAM + 24K E(E)PROM OR STATIC RAM

"Big Board II" has the three memory banks. The first memory bank has eight 4164 RAMs that provide 60K of user space and 4K of monitor space. The second memory bank has two 2Kx8 SRAMs for the memory-mapped CRT display and space for six 2732 As, 2Kx8 staticRAMS, or pin-compatible E(E)PROMs. The third memory bank is for RAM or ROM added to the board via the STD bus. Whether bought as a bare board, a full kit, Or assembled and tested, it comes with a 450nS2732 EPROM containing the monitor.

MULIPLE-DENSITY CONTROLLER FOR SS/DS FLOPPY DISKS

The new Ferguson single-board computer has a multiple-density disk controller. It can use 1793, 1797, or 8877 controller chips since it generated the signal with TTL parts. The board has two connectors for disk signal with 34 pins for 5.25" drivers, the other with 50 pins 8" drives.

VASTLY IMPROVED CRT DISPLAY

The new Ferguson SBC uses a 6845 CRT controller and 8002 Video Attributed controller to produce a display that will rival the display of quality terminals. Characters are formed by a 5x7 dot matrix on 15.75 KHz monitors and 7x9 dot matrix on 18.60 KHz monitors. The display is user programmable with the default display 24 lines of 80 characters. 8002a chip supplied for 18 to 60 kHz monitors.

STD BUS CONNECTOR

The Ferguson computer brings its bus signals to a convenient place on the PC board where users can solder an DSTD, bus cards can be plugged directly into it, and it can as well be connected by bus cable to industry-standard card cages.

DMA

The new Ferguson computer has a Z80-A DMA chip that will allow byte-wise data transfers at 500K bytes per second and bit serial transfers via the Z80-A S10 at 880K bytes per second with serial processor overhead, though the monitor for the new computer uses the DMA chip mainly for transferring data to and from disk, the chip can readily be used for other things since its "wait/ready" pin can be connected under software control to some half a dozen signal lines. When a hard-disk subsystem is connected to the "Big Board II" via its "SASI" interface, the DMA chip makes breathtaking disk performance possible.

"SASI" INTERFACE FOR WINCHESTER DISKS

The "Big Board II" implements the Host portion of the "Shugart Associates Systems Interface". Adding a Winchester disk drive is no harder than attaching a floppy-disk drive. A user simply 1: Runs a 50-conductor ribbon cable from a header on the board to any of several inexpensive controller cards for Winchester drives that implement the controller portion of the SASI interface. 2: Cables the controller to an appropriate drive, and 3: Provides power for the controller-card and drive. Since our CBIOS contains code for communication with hard-disk, that's all a user has to do to add a Winchester to a system!

A Z80-A S10/0 = TWO ASYNCHRONOUS/SYNCHRONOUS SERIAL PORTS

A PARALLEL KEYBOARD PORT = FOUR OTHER PARALLEL PORTS USER 1/0

The new Ferguson single-board computer has one parallel port for an ASCII keyboard and four others for user-defined 1/0. When the computer is powered-up or reset, the monitor looks for a carriage-return at the keyuboard and serial ports. If the first carriage-return the monitor gets comes from the parallel keyboard, the monitor uses the board's video display circuitry to communicate with the user via a CRT. If the first carriage-return is typed at an ASCII terminal attached to a serial port, the monitor autabauds and makes the terminal the system console.

TWO Z80-A CTCs = EIGHT PROGRAMMABLE COUNTERS/TIMERS

The new Ferguson computer has two Z80-A CTCs. One is used to clock data into and out of the Z80-A S10/0, while the other is for systems and application use.

PROM PROGRAMMING CIRCUITRY AND SOFTWARE

The new Ferguson SBC has circuitry and drivers for programming 2716s, 2732(A)s, or pin-compatible (E)EPROMs. Software $25 extra.

CP/M

CP/M with Russell Smith's CBIOS for the new Ferguson computer is available for $220
The CBIOS is available separately for $65
Actual board size: 39.6cm x 22.2cm. 5 inch BIOS being developed. Approx price $95.

Pricing and Availability:

Available ex-stock

In single quantities, full kits cost $695 plus tax , and A&T'd computers cost $895. There are attractive discounts that range to 35% for OEM's and dealers. For details about them please call Rod Irving on (03) 489 7099. ie: 3 Ferguson II "Big Board" are less 20% off the one-off price, hard disks disk controllers, boxes and power supply to suit both 8" & 5¼" systems will be available.

Bare board with main chips now available (includes PCB, Manual, PALS, Monitor ROM, SMC chips). You have to add rest of components at $395 + tax

Errors and omissions excepted.

correspondence course reviewed

Understanding the microprocessor —

If you have a basic knowledge of electronics you can study this course at home and learn how a microprocessor actually works. How it functions, how it is programmed and how it may be used in a variety of applications will all be revealed.

Jennie Whyte

LEARN HOW MICROPROCESSORS eally work — the practical way' said the rochure from the Australian School of Electronics. It sounded interesting so I hought I'd do this correspondence course, ot realising that I was committing myself to everal months of study which had to be one mainly on the weekends.

However, I did find that the time spent n this course was worthwhile; it was intersting, I learnt how a microprocessor funcons and I learnt how to program in achine code.

This 'Master the Microprocessor' course organised by the Australian School of lectronics in Melbourne. The course was ritten by the British National Radio & lectronics School, Department of Comuter Technology, England, and developed round the MPF-1B Microprofessor.

It was designed to "provide the necessary asic information to enable a student to eally understand the functioning of microocessors and their supporting circuitry. his is backed up by showing how to proam a microcomputer in machine code as ell as showing how Assembler and higher vel languages relate to this".

The Australian School of Electronics aff say that the course is a useful introducon for people with an electronics backound who want to install and service icroprocessors, design systems or just ant to understand microprocessor control nctions and their applications.

hat you get

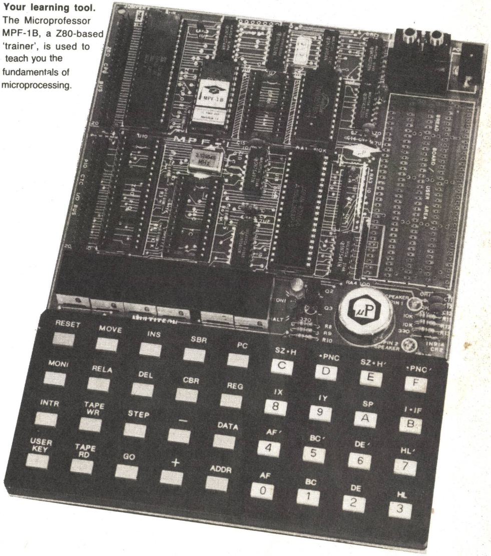
he cost of this course is $490; this includes e MPF-1B Microprofessor which comes mpletely assembled and ready to use, ght text books and eight test papers. Each udent is assigned a tutor who marks each st paper and returns it to the student with mments. The tutor is also available to nswer any written queries the student may ve.

The MPF-1B, manufactured by Multitech dustrial Corporation, is a Z80-based icrocomputer system which is described as learning tool for hobbyists, students and icroprocessor enthusiasts. It has 2K of AM, a 6-digit, 7-segment LED display d a keyboard of 36 keys for hexadecimal ta entry. (See ETI October 1982 for a view of the MPF-1 Microprofessor.)

Although this course is based on the Z80 microprocessor it emphasises the common features which exist between processors from different manufacturers i.e: the Intel 8080 and 8085.

It is claimed that no previous knowledge of computers is necessary. However, a basic knowledge of electronics plus digital and logic circuits is essential. It is assumed that the student has a knowledge of electronics up to a minimum level of transistor theory and circuits.

A short introductory course covering digital/logic theory is available, at no extra ▶



Your learning tool. The Microprofessor MPF-1B, a Z80-based 'trainer', is used to teach you the fundamentals of microprocessing.

COURSE CONTENTS

Lesson 1. Logic levels, flip-flops, input/output, binary/decimal conversions, hexadecimal notation, RAM, ROM, CPU registers and timing, ports latches, buss systems.
Lesson 2. Monitor program, keyboard: reset, register, address, increment/decrement, data, program counter, step and go; flowcharts are explained, a short program is given as an example with an explanation as to how to enter it and check the operations, stack pointer, subroutines.
Lesson 3. Interrupt systems, interrupt masks, Z80 interrupt modes, demonstration programs, stack 'push' and 'pop' instructions, object and source code, data transfer instructions.
Lesson 4. Addressing modes, flags, demonstration program with execution instructions to illustrate use of zero flag and register indirect addressing, breakpoint, demonstration of use of carry flag and some data transfer instructions — students are asked to write their own program first and then compare it with program in the text, jump instructions.

Lesson 5. Binary arithmetic, hexadecimal arithmetic, tens and twos complements, signed and unsigned numbers, program demonstrating addition and subtraction instructions, demonstration of add with carry and subtract with borrow, program for division.
Lesson 6. Binary coded decimal, decimal adjust instruction with demonstration program, instructions providing AND, OR and exclusive OR functions, demonstration program of Boolean logic instructions, shift and rotate instructions with demonstration program, demonstration of use of logic and arithmetic instructions in multiplication algorithms — programs are given for the multiplication of two 4-bit and two 8-bit binary numbers, program for the additional of multi-byte numbers.

Lesson 7. Now that a range of instructions has been demonstrated, this lesson moves onto discussing memory and input/output interface circuitry which may be used to provide a range of different facilities; RAM, ROM, PROM, EPROM, EPROM programmer, serial and parallel access, address decoding and chip selection, complete with partial decoding, 8255 PPI, mode definition control word, driving the display, reading the keyboard, programs to demonstrate use of output and input ports.

Lesson 8. Interface providing paralle data transfer between instruments serial communications interface, direc memory access controller, CRT controller, counter/timer circuits, buffers analogue to digital converters, duple and half duplex operation, serial bau rate, synchronous and asynchronou modes, serial communications interface package, character codes, CRT interface, memory mapped I/O, practical demonstration of use of I/O port t provide an event counter, high leve languages introduction, servicin microprocessor-based equipment.

cost, when requested by the student. However, it doesn't cover basic electronics. Without this basic knowledge the student would not be able to cope with this course.

The text of the course is arranged in a logical order. A description of the hardware is accompanied by instructions in programming.

Following descriptions in the text on new functions or techniques, a practical demonstration is given using the microcomputer. The notes give a flow chart accompanied by an explanation and the program is written out in full with the address, object code, source code and comments explaining the meaning of the source code. Later in the course the student is asked to write the program first before checking it with the given program.

Step-by-step instructions are given on how to enter the program into the computer and also on how to verify the contents of the accumulator and registers. This demonstrates very clearly how the system operates.

After each lesson book has been studied and all the questions have been answered on the corresponding test paper, the completed test paper has to be sent to the tutor assigned to the student. The tutor marks the paper and returns it with comments on the wrong answers.

I usually found that the comments were helpful, giving the correct answer with an explanation. However, on a couple of occasions I was told to read the text again and resubmit my answer. I didn't find that very constructive, especially as I'd already spent more time than should have been necessary studying the relevant text. I assumed that the information must have been somewhere in the notes, but finding it was a problem; the notes were sometimes not clear and the facts were scattered.

It seemed to me, after several frustrated attempts to find specific information to answer questions, that the course had been written by someone who is so familiar with microcomputers that many essential basic explanations had been overlooked. This is not an uncommon practice, unfortunately, and is often the case with technical manuals.

There are 6-10 questions on each test paper. Each question has a multiple choice answer and the instructions are to tick the box you believe corresponds to the correct answer.

However, it wasn't explained that only one of the possibilities could be correct. I once ticked three out of the four statements as they all seemed to be correct. But I was later told that the test questions in this course only allow for one correct statement.

I must admit that I was lulled into a false sense of security when I first saw that the answers were all multiple choice. However, it doesn't make the test papers any easier.

I treated this course seriously; read each text book carefully, did all the examples and worked through the programs on the MPF-1B. At first I thought that I would then be able to answer the test paper without referring back to the lesson book. But it wasn't that easy.

I think that there was a deliberate conspiracy to make me study the text book again. A good plan, I suppose, to make sure that the text has been read thoroughly. However, as I have already mentioned, it wasn't easy to find specific information to answer a question.

Sometimes I eventually found this information in the MPF-1B User Manuals but it was a frustrating experience trying to find anything in them. As there was no index for these manuals I wasted a lot of time familiarising myself with the contents so that I would know what was in them and where to find it.

Course revisions

The 'Master the Microprocessor' correspondence course was only started in Australia in August 1983. As I was the first student it was not surprising that I came across some areas that could be improved. Since completing the course I have discussed it with the staff of the Australian School of Electronics and they are making some alterations to the course structure. The main revisions are in the following areas.

1. Index. An overall index is being compiled which, for practical purposes, will be kept separate from the text books and user manuals. This index will make it easy to refer back to any topic covered in the course.

2. Lesson books. The British Nationa Radio & Electronics School, which designed this course, has told the Australia School of Electronics that it is currentl assessing the text and, where necessary rewriting it. But who knows when we wi see that in Australia. So the Australians ar also going through the course and insertin extra information.

3. User Manuals. The British School is als assessing the User Manuals. However, th Australian School is ahead of them; whe ever reference is made in the text to th User Manuals (for programming instru tions, tables, etc) they are actually insertin that information into the lesson boo Hopefully, this will eliminate having to co sult several books when answering th questions.

4. Study guide notes. These notes will be i corporated at the beginning of each lesso book. They will prepare the student for th particular lesson, emphasising certain se tions where new concepts are discusse

5. Test guide notes. These will be attache to each test paper, giving useful clues, hint etc, especially on the more 'tricky' que tions. The intention of these notes is not make the tests any easier but to elimina ambiguous questions which could misinterpreted.

6. Discussion notes on tests. These will sent to students with their corrected te papers and will contain any extra inform tion which may be useful. These notes w concentrate on the questions which appe to cause the most difficulty.

7. Model answers. Model answers with e planations will be given for each questio They will be sent to the student with t corrected test paper.

Conclusions

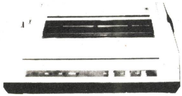
I found the course very useful and definite worth the effort. Now that the course h been assessed and improved with the add tional notes it will certainly be worthwhil if you want to learn about microprocesso in your own time at home.

If you would like to enrol in any of t courses run by the Australian School Electronics contact **Bert Horszowski, Scho Director, P.O. Box 108, Glen Iris Vic. 314 (03)523-5622.**

ONE MONTH ONLY SALE (TILL END FEB 84)

C. Itoh PRINTERS

FROM ROD IRVING ELECTRONICS



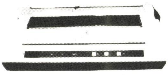
Pro/Writer Printer 8510

Print Features: Number of columns—136 col. max. Print Speed—120 CPS. Print Direction—Single-directional and Bidirectional, Switch Selectable. Throughput Speed—From 44 to 152 lpm. Character spacing (max. number of columns per line)—Pica 10 CPI (80), Double Width 5 CPI (40), Compressed Font 17 CPI (136), Double Width 8.5 CPI (68), Elite 12 CPI (96), Double Width 6 CPI (48), Proportional Double Width Proportional. Line Spacing—Variable to 1/144". Print Width—203 mm (8") max.
Forms Type: Fan Fold Roll or Cut Sheet: Width—113 mm to 254 mm (4.5" to 10.0"). Total Thickness—0.05 to 0.28 mm (0.002" to 0.011"). Number of Copies—Original + 3 copies nominal.
Form Feed: Method—Tractor or Friction. Form Loading—Either rear or top.
Interface—Serial: Method—EIA RS232-C and 20mA (40 & 60mA switchable option) Current Loop Serial Interface. Baud Rate (BPS)—110, 300, 600, 1200, 2400, 4800, 9600. Transmitting Method—Half Duplex. Synchronization—Asynchronous.
Interface—Parallel: Method—TTL compatible, 7-bit, parallel interface. Control Signals—ACK, BUSY, SELECT, DATA STB, INPUT PRIME FAULT, INPUT BUSY, PAPER EMPTY. Instruction Codes—(ASCII): CR, LF, VT, FF, CAN, SO, SI, DEL, DC1, DC2, DC3, DC4, GS, RS, US, FS, EM; GRAPHIC SYMBOLS: BIT GRAPHICS.
Error Detection: (1) Parity (VRC)—Odd, Even, No-parity. Switch selectable. (2) Framing Error—Stop bit check. (3) Overrun Error—Error is detected when data are received before the previous data have been processed.
Physical dimensions: 398 mm W x 120 mm H x 285 mm D (15.7" W x 4.7" H x 11.2" D).
Weight: 8.5 kg (18 lbs., 12 oz.)

Special Prices
till Feb. 29th 1984

tax exempt

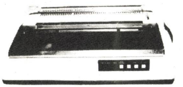
P* $795 ($695)
S** $1095 ($945)



Model 1550

The Model 1550 is a compact desk-top dot matrix serial impact printer used for data communication terminals, hardcopy of CRT displays, peripheral terminals for minicomputers and microcomputers, and small-sized business systems.
The character format is a dot matrix of 7(H) x 9)(V). or 8(H) x 8(V).
Print speed is 120 characters/second. Up to 136 characters can be printed per line at 10 CPI.
Its main features are: ● Compact desk-top dot matrix printer ● 136-column print ● Lightweight ● Low power-consumption ● High-quality print ● Bit image graphics ● Graphic Symbols ● Prints in six different languages ● High reliability ● Low cost.

P* $1095 ($995)
S** $1395 ($1295)



F-10 Printmaster Daisy Wheel Printer

Print Speed: 40 CPS. **Print Method:** Static Print Impact. **Number of Printable Columns:** 136, 163, Variable. **Character Spacing:** 1/120 Inch (minimum). **Line Spacing:** 1/48. **Return Time:** 900 msec. **Line Feed Time** 40 msec. **Paper Width:** 406 mm (maximum). **Print Characters:** 96. **Printwheel:** Industry Standard 96 Character Wheel. **Interface:** Industry Standard 8-bit Parallel, RS232-C Compatible, X-ON, X-OFF, 12-bit Qume and Diablo Compatible. **Dimensions:** 574 mm W x 405 mm d x 153.5 mm H (22.5" W x 15.9" D x 6" H). **Weight:** 14 kg (30.8 lbs.) with cover and power supply. **Noise:** Less than 65 Db (1M from Platen, A Scale).

P* $1950 ($1675)
S** $2200 ($1875)

* Parallel Interface ** Serial Interface

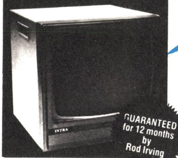
NEW VIDEO MONITORS

Get a clear honest image!

Computer data and graphic displays never looked better, brighter, sharper

High Resolution

- Recommended Display Characters: 1920 (80x24).



GUARANTEED
for 12 months
by
Rod Irving

SCHOOL AND CLUB BULK BUYS — Please ring for pricing

- High quality non-glare CRT
- Compact and Lightweight with all Controls Inside Front Panel
- All units 100% Factory Burned-In
- 800 lines centre resolution
- Suitable for Apple — and other computers (Apple is a registered trademark of Apple Computer Computer Inc.)
- Green or Orange Phosphor available
- 18 MHZ
- First Shipment arriving middle of June 1983
- Direct Import Price for June

Green Phosphor $189 ($163 Ex)
Orange Phosphor $209 ($169 Ex)

GREAT VALUE

'THE PRINTER PEOPLE' SPECIALS

Just Arrived

Patented New Head

A NEW PRINTER NOW!

CP-80/I, 80-COLUMN IMPACT PRINTER

SPECIFICATIONS

Functional Specifications

Printing method — Serial impact dot matrix.
Printing format — Alpha-numeric — 7 × 8 in 8 × 9 dot matrix field. Semi-graphic (character graphic) — 7 × 8 dot matrix. Bit image graphic — Vertical 8 dots parallel horizontal. 640 dots serial/line.
Character size — 21 mm (0.083")-W × 2.4 mm (0.09")-H 7 × 8 dot matrix.
Character set — 228 ASCII characters. Normal and italic alpha-numeric fonts, symbols and semi-graphics.
Printing speed — 80 CPS 640 dots/line per second.
Line feed time — Approximately 200 msec at 4.23 mm (1/6") line feed.
Printing direction — Normal — Bidirectional logic seeking. Superscript and bit image graphics — Unidirectional left to right.
Dot graphics intensity — Normal — 640 dots 190.5 mm (7.5") line horizontal. Compressed characters — 1,280 dots/190.5 mm (7.5") line horizontal.
Line spacing — Normal — 4.23 mm (1/6"). Programmable in increments of 0.35 mm (1/72") and 0.118 mm (1/216").
Columns/line — Normal size — 80 columns. Double width — 40 columns. Compressed print — 142 columns.
Compressed double width — 71 columns.
The above can be mixed in a line.
Paper feed — Adjustable sprocket feed and friction feed.
Paper type — Fanfold Single sheet. Thickness — 0.05 mm (0.002") to 0.25 mm (0.01"). Paper width — 101.6 mm (4") to 254 mm (10").
Number of copies — Original plus 3 copies by normal thickness paper.

Mechanical Specifications

Ribbon — Cartridge ribbon (exclusive use), black.
MTBF — 5 million lines (excluding pring head life).
Print head life — Approximately 30 million characters (replaceable).
Dimensions — 377 mm (14.8") -W × 295 mm (11.6") -D 125 mm (4.9") -H incl. sprocket cover.

Parallel CP80 $399
Serial CP80 $559

2000 Sheets
"Keen Edge" Paper
$39.50

ERRORS AND OMISSIONS EXCEPTED

ROD IRVING ELECTRONICS

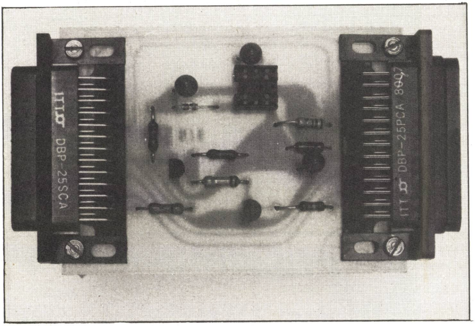
425 HIGH STREET, NORTHCOTE 3070. MELBOURNE. (03) 489-8131
NOW OPEN AT 48–50 A'BECKETT STREET, MELBOURNE (03) 347 9251

TO ORDER: Heavy items sent Kwikasair Freight Prepaid.
Mail Order Phone 481-1436. Wholesale Customers
Phone: 489-7099. Mail Orders to RITRONICS WHOLESALE, P.O. Box 235, Northcote 3070
Minimum P&P $2. Add extra for heavy items, registration and certified mail.
Prices and specifications subject to change without notice.

bankcard

Bankcard mail orders
ORDER FORM
Please Debit my Bankcard
No. ....
Expiry Date ....
Name ....
Signature ....

A 'fair dinkum RS232er' for the Microbee



The Microbee, among other home computers, has a 'sort of' RS232 port in that it doesn't implement the negative-going portion of its output signal (TxD). Most peripherals with an RS232 input can cope with that, but inevitably, there are those that can't — as Bob found out. This project fixes that.

Bob Martindale VK3BMA

HAVING HAD my Microbee for over 12 months, and after playing the usual games, etc, it came time for some 'serious' work for the machine. At about this time, I gained access to a high quality daisy-wheel type printer — a Diablo 1650 word processor terminal (*very* smart!) — which, fortuitously, is provided with a 1200 baud RS232 interface socket. Bewdy! I thought, and proceded to make arrangements to obtain super quality listings of my programs. After checking port pinouts, a patch cable was assembled and the system fired-up. It didn't work!

Application of an oscilloscope indicated that the Microbee's TxD output signal was switching between 0 V and about +10 V. Reference to the 'Bee's circuit diagram revealed a transistor switching stage powered from the +12 V (nominal) supply rail. A quick check of Graham Wideman's article *Beating the RS232 Blues* in ETI for August 1982 indicated there should also be a negative signal excursion of between 3 V and 12 V amplitude if, in fact, the Microbee's output was to be 'true' RS323. Hmmm ... could that be the culprit?

I quickly assembled a switching adaptor (two transistors) powered from positive and negative supply rails on solderless breadboard and tried the system again. It worked first up, and voila! — super quality printouts.

I then reassembled the circuit on a small piece of Veroboard, adding a negati supply rail inverter (Intersil ICL7660) make the unit self-contained and capa of being powered from the Microbe supply rail (available on pin 9 of t RS232 port). I managed to make it sm enough to mount, out of sight, inside t backshell of a DB25 plug. However, B has made a pc board version that sim 'inserts' between the 'Bee's RS232 p and the peripheral's RS232 plug.

Construction

Assembly diagrams are given for both t Veroboard and pc board versions. track-cutting diagram is given for t Veroboard. This should be done first

PARTS LIST — ETI-676

Resistors	all ¼W, 5%
R1	220R
R2	220k
R3	22k
R4	100k
R5	3k3
R6	1k
Capacitors	
C1, 2, 3	10μ/10 V tant.
Semiconductors	
D1	1N914, 1N4002, etc
IC2	ICL7660
Q1	BC549
Q2	BC558
ZD1	6V8 zener

Miscellaneous

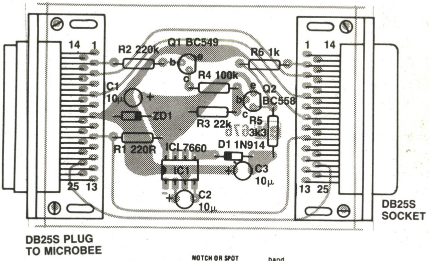
ETI-676 pc board; DB25P right-angle pc mount plug; DB25S right-angle pc mount socket; 4 x 4BA bolts, nuts and washers.

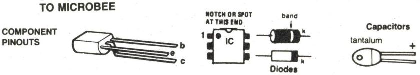
Price estimate $32-35

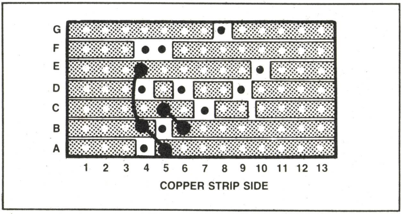
you're assembling the project this way. Note that two links are required, but these should be soldered in later. An IC socket may be used for ICI but note that pins 1, 5 and 7 *do not* make connection to the copper strips of the Veroboard. If you're using a socket, snip off or remove pins 1, 5 and 7, otherwise cut off the pins from the IC.

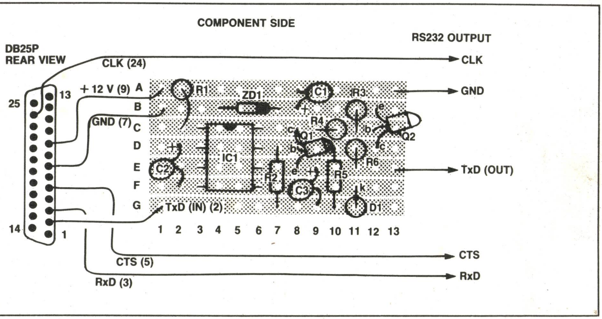
The components can be assembled in ny order, but, as usual, watch orientation of the semiconductors and tantalum capacitors. Note that some components are stood on end. Seat the components right down on the board and you'll fit the project in a DB25 backshell without too much difficulty. Wire the assembly to the DB25 plug with short lengths of hookup wire nd wire the cable to TxD and GND. Note that RxD, CTS and CLK should be wired straight through to the DB25 plug.

The pc board version is also simple to ssemble. Just follow the overlay. Careully check the pc board before assembly. ▶







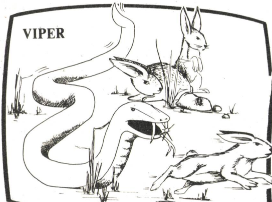


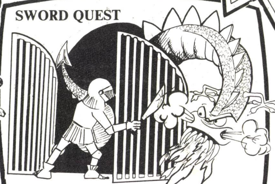
▶

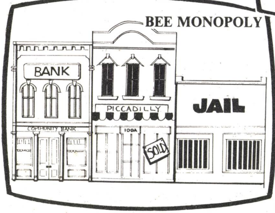
microbee®

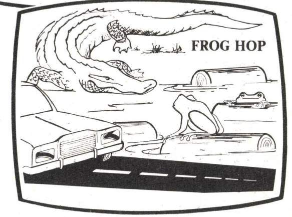
DYNAMIC SOFTWARE

New for '84









- EDUCATIONAL
- UTILITY
- GAMES

VIPER
A highly addictive game. You must eradicate the rabbits before they reach plague proportions but each time you catch a rabbit your tail grows.
Cassette $14.95 ..... Diskette $19.95

BEE MONOPOLY
Now a full graphic version of the old family game of the same name. The entire board, players, Community Chest and Chance cards are displayed as required in this fast moving game. Full details of land ownership and finances. Superb graphics and sound effects. (Requires 32K).
Cassette $14.95 ..... Diskette $19.95

SWORD QUEST
Just like the 'Dungeons and Dragons' series. Select your characters level of armour, weapons, strength and skill. Explore in search of treasure and the Great Sword, and battle with the dungeon's creatures.
Cassettee $14.95 .... Diskette $19.95

FROG HOP
A most graphic variation of the popular arcade game. You must hop across a busy street (watch out for the trucks . . .) and across a crocodile infested stream before your frogs are safely home. Guaranteed to appeal to all ages.
Cassette $14.95 ..... Diskette $19.95

NOW AVAILABLE ON CASSETTE OR DISKETTE

MANY HAVE JOYSTICK CONTROL & COLOUR OPTIONS

OBOT MAN '84
low one of the most popular games ever ritten for the **microbee** has been rewritten ith new twists, a joystick and colour option.
assette $14.95 .... Diskette $19.95

ICROSPACE INVADERS '84
ew update of one of the original **microbee** ames. Now with full colour and joystick ption. Sound and speed controls. Turn your **icrobee** into a home arcade machine.
assette $14.95 .... Diskette $19.95

RAMBLER
full colour version of the popular arcade me. You are the sole surviving defender of rth and you must destroy the aliens at all st . . . very effective colour graphics (also itable for non colour **microbees**).
assette $14.95 .... Diskette $19.95

YE OF MIN
graphic adventure game that will absorb u for hours. If you can solve this excellent ystery then you can proceed to the next saga bre of Sultan'. (Requires 32K).
ssette $14.95 .... Diskette $19.95

LECTRONIC HOBBY MATE
real first. This clever program deals with sistors, capacitors, electronic terms and ntains a wealth of 'live' information. A must all experimenters. Your **microbee** will come a useful design aid.
ssette $14.95 .... Diskette $19.95

UTORIAL: Touch Typing Tutor and Basic icks. The **microbee** is an ideal educational mputer recommended by educational thorities across Australia. This package ables you to learn to touch type using the man touch typing method. For those who nt to master Microworld Basic there is a ies of hints and suggested subroutines anged in a most effective menu driven style.
ssette $14.95 .... Diskette $19.95

NG OF DOOM
ur quest is to search for the Dark Lord of rean's Ring of Power. This action adven- e game will operate in a 16k **microbee**.
ssette $14.95 .... Diskette $19.95

SKETCH PAD
Use the high resolution graphics in your **microbee** with this most effective drawing aid. Ideal as an introduction to Cad techniques and you can create complex shapes with a little practice. You can also 'trace' from images taped onto the screen to generate faithful reproductions. Have you ever wondered how programmers create the graphics for their software?
Cassette $14.95 .... Diskette $19.95

CHOPPER PILOT
Fly your helicopter through a small city and a series of mazes without crashing into the scenery. Has a training mode as well as the real thing for those who want to practice first. Now with joystick option.
Cassette $19.95 .... Diskette $19.95

GENIUS AND INSANITY
Yes, those insanity blocks are back! The game has several levels of difficulty but really serves as a vivid demonstration of the **microbee** colour graphic capability.
Cassette $14.95 .... Diskette $19.95

CHESS/CHESS TUTOR
For those who enjoy a serious graphics game it is hard to beat Chess. If your game needs improving try the tutorial first. You can select from 6 levels of play and these can be altered during the game. This program features very good graphics and, particularly at the higher play levels, becomes a most worthy opponent. (32k **microbee** recommended).
Cassette $14.95 .... Diskette $19.95

TARGET/TREK
These are two of the 'classics' of computer games and will still impress with the use of characters to emulate graphics (remember they only had teletypes on the 'old' days around 1976). The challenge of Trek will attract even the most ardent 'anti games freaks'.
Cassette $14.95 .... Diskette $19.95

LEARNING CAN 'BEE' FUN
Now the full series by John Grimley in one value package containing 6 cassette tapes (or 1 diskette). Utilizing well known games such as 'Donkey Kong', 'Frog Hop' and 'Rescue' you can enjoy the game and learn at the same time.
Cassette Library Pack $49.95
Diskette $39.95

WORD ADVENTURE
A powerful and gripping educational program. Follow the trails by solving problems involving homonyms, synonyms and antonyms. Various creatures will meet you along the trails and give you clues to the words you seek. If you make too many errors you will certainly have to face the spelling serpent who will test your fate. Once you master the first game you will learn a password which will enable you to load the next secret program. (Requires 32K).
Cassette $14.95 .... Diskette $19.95

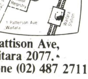
'BEE' CASINO
Another value package with a collection of all the popular gambling/casino games written for the **microbee**. No need to take the wife to Las Vegas or Wrest Point! This makes ideal party material for after the kids go to bed.
Cassette Library Pack $39.95
Diskette $39.95

BEE SCIENTIST: Physics and Chemistry Laboratory. A collection of practical experiments and courses on physics and chemistry. You can study chemical equations, valency, Kepplers laws, Coulombs Laws and Milliken's experiment. A valuable teaching aid now used in schools.
Cassette Library Pack $49.95
Diskette $39.95

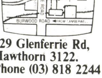
FREE DELIVERY OF SOFTWARE for Direct Orders

Ask your nearest microbee dealer for a catalogue of over 100 microbee programs now available on cassette, diskette and ROM covering applications in education, games and utility functions.

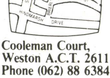
microbee computer shops



1 Pattison Ave,
Waitara 2077.
Phone (02) 487 2711



729 Glenferrie Rd,
Hawthorn 3122.
Phone (03) 818 2244



Cooleman Court,
Weston A.C.T. 2611.
Phone (062) 88 6384

141 Stirling Highway,
Nedlands, Perth.
Phone (09) 386 8250

bankcard
welcome here

DIRECT ORDERS
PHONE (02) 487 2711

APPLIED TECHNOLOGY RETAIL PTY LTD

microbee

Authorised Dealers:

NSW: **Jaycar,** (inc. Electronic Agencies)
117 York Street, Sydney.
115 Parramatta Road, Concord.
121 Forest Road, Hurstville.
Cnr Carlingford and Pennant Hills Road, Carlingford.

Compu-K, 7 Casino Street, Lismore.

Comput/Ed, 8 Park Arcade, Park Avenue, Coffs Harbour.

ACT: **Computech,** Belconnen Churches Centre, Benjamin Way, Belconnen.

VIC: **Computerland South Melbourne,** 37 Albert Road, Melbourne.

S.A.: **Key Computers,**
1061 South Road, Edwardstown.
77 Grenfell Street, Adelaide.

W.A.: **Altronics,** 105 Stirling Street, Perth.

QLD: **Software 80,** 105 Milton Road, Milton.

Electrographic Office Systems, 25 Grafton Street, Cairns.

Town and Country Computers, CTL Centre, Anne Street, Aitkenvale, Townsville.

TAS: **Central Data,** 14A Goodwin Street, Launceston.

NEW LOWER PRICES!

Microbee-No.1 for computers
Jaycar -No.1 for Microbee

microbee®

Jaycar Electronic Agencies is proud to announce the 1984 range of microbee computers – at new low prices!! The microbee Series 2 machines are ALL supplied with built-in communications capability, dual font 80 character by 24 line & 65 character by 16 line displays. Remember, your microbee is obsolete-proof with g'teed upward expandability.

CALL IN TO OUR STORES FOR A FREE COLOUR MICROBEE CATALOGUE

microbee Series 2 EXPERIMENTER

By popular request, the low cost **microbee Series 2 Experimenter** has been designed for those who are starting out in the fascinating world of computers or those who want to share the fascination of exploring the exciting developments in the fast moving **MICRO WORLD.**

Demand for projects using the **microbee** is so great that 'Electronics Today' are now planning to run a **microbee** project every month during 1984. So far ETI has described the light pen, EPROM programmer, a radio TTY printer, the world's first home facsimile receiver and ROM expander board for the **microbee.** Virtually every local computer magazine has run reviews and/or columns devoted entirely to the **microbee.** If you want to be part of the MICROCOMPUTER GENERATION in 1984 then **microbee** Series 2 Experimenter is the ideal starting point. Of course you can expand your **microbee Series 2 Experimenter** as your need grows.

$399

Cat. XE-4000

Note: the software that is supplied with each machine – at no extra charge!!

microbee Series 2 EDUCATOR

The **microbee Series 2** was specifically designed to serve the needs of the EDUCATION MARKET. Let's face it, the primary non-business use for most personal microcomputers is to increase our learning capabilities either about computers (computer awareness) or about life itself. **microbee Series 2** has now been officially approved by Education Departments in NSW, WA and Queensland and is being carefully considered in virtually all other states and by the National Schools Commission at the time this ad was going to press.

The **microbee Educator** uses BATTERY BACKED NON-VOLATILE CMOS RAM so your programs are saved in the **microbee Series 2** after the power is switched off. Students can bring the **microbee Series 2 Educator** home from school to complete assignments ready for class the next day. With the optional BEEMODEM you can use your **microbee Series 2 Educator** to talk to other computers or information networks.

$449

Cat. XE-4050

microbee Series 2 PERSONAL COMMUNICATOR

With the BUILT-IN WORDBEE in ROM as well as MICROWORLD BASIC and NETWORKING, the **Personal Communicator** is a powerful home computer ideal for virtually any home use from wordprocessing, spreadsheet analysis, eduction and even experimentation with the computer concepts as they evolve during the year. With the optional BEEMODEM you can send WORDBEE files across any telephone line to another computer. Bee the first on your block to have home telex!

$499

Cat. XE-4100

microbee Series 2 ADVANCED PERSONAL COMPUTER

Now for the first time in Australia: the **microbee Series 2 Advanced Personal Computer** with 400K disk drive. Then add bundled world class software such as CP/M, MICROSOFT BASIC, MULTIPLAN, WORDSTAR and a powerful library of support programs and you will have some idea as to why the **microbee Series 2 Advanced Personal Computer** is the most powerful and best price/performance computer in its class. What's more any existing **microbee** owner can convert his **microbee** to the **Series 2 APC** at any time.

The **microbee Series 2 APC** uses the popular Z80 microprocessor and runs standard CP/M so that users have access to the vast library of CP/M software available world wide. MICROSOFT BASIC is now supplied on disk. WORDSTAR, according to independent surveys now accounts for 50% of ALL word processing software now in use so the designers of the **Series 2 APC** decided to purchase the OEM rights for your benefit. MULTIPLAN is considered by many to be one of the most powerful spreadsheets yet produced for the microcomputer.

$1495

Cat. XE-4200
SINGLE 400K DISK DRIVE

$1795

DUAL 400K DISK DRIVE
Cat. XE-4300

NEW GAMES FOR MICROBEE

KING KONG – from MYTEK

Just like the arcade game of a similar name. The game consists of several frames which you must complete to rescue your sweetheart from Kong. Excellent graphics and sound. Joystick compatible.

Cat. XE-7054 $20.00

CHOPPER – from MYTEK

A fast action packed game which must rate as one of Mytek's best. You have full control of a helicopter and you must fly over enemy lines to rescue your allies. Fast realistic graphics and excellent sound.

Cat. XE-7055 $20.00

SKETCH PAD

A program to help you design your own P.C.G. characters. Simple commands allow easy drawing of circles, polygons and boxes etc. These then can be dumped to tape to be used in a future program. Comes complete with manual.

Cat. XE-7056 $19.95

PRINTERS MATE

This program is two screen dump programs to suit CP80, MX80, DT80, 80DP and FAX80 printers. One program is a screen dump utility while the other prints out memory contents in both hexidecimal and ASCII characters. A must for use with printers.

Cat. XE-7051 $17.50

DUO – ONE

Another two programs for the price of one from Dreamcards. One side has poker, and the other is Casino which is a three reel poker machine. Both use Hires graphics. Excellent value.

Cat. XE-7052 $15.95

EXTENDED TURTLE

A "Turtle" program which has been written by a teacher and has been several months in the writing. This is one of the best Turtle programs written and comes complete with a 40 page clearly written manual with many helpful drawings.

Cat. XE-7053 $29.50

Jaycar Incorporating
ELECTRONIC AGENCIES

SHOWROOMS

SYDNEY
117 YORK STREET – PHONE: (02) 264 6688 and (02) 267 1614
TELEX: 72293
CARLINGFORD
Cnr. CARLINGFORD & PENNANT HILLS ROAD – PHONE: (02) 872 4444
CONCORD
115 – 117 PARRAMATTA ROAD – PHONE: (02) 745 3077
HURSTVILLE 121 FOREST ROAD – PHONE: (02) 570 7000

NUMBER 1 FOR KITS

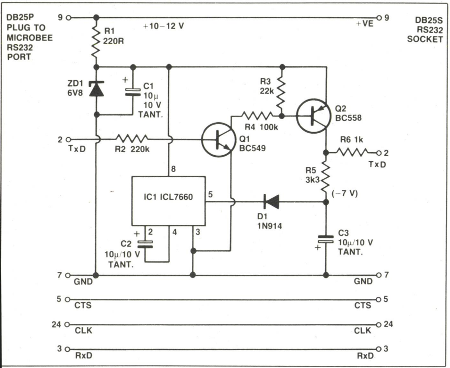
POST AND PACKING CHARGES

$5 – $9.99 ($1.50)	$10 – $24.99 ($3.20)
$25 – $49.99 ($4.50)	$50 – $99.99 ($6.50)
$100 – $198 ($8.00)	Over $199 ($10)

"Free INSURANCE for Road & Registered Post over $200"
All heavy or bulky items (over 20kg.) sent Comet Road Freight $12.00 anywhere in Australia.

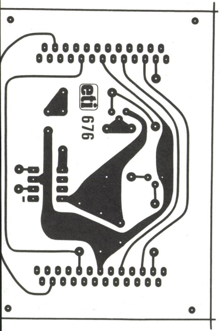
SHOP HOURS CARLINGFORD, CONCORD & HURSTVILLE
Mon – Fri 9am – 5.30pm: Sat – 9am – 12pm: Thurs night 8.30pm
SHOP HOURS SYDNEY
Mon – Fri 8.30am – 5,30pm. Sat – 8.30am – 12pm: Thurs night 8.30pm
MAIL ORDERS AND CORRESPONDENCE: P.O. Box 185, Concord, 2137.

Mail Order By BANKCARD Via Your Phone



ount the resistors, capacitors and semi- nductors first, taking care to correctly ientate the semiconductors and tantalum pacitors. Mount the DB25 plug and cket last — making sure you get each at e correct end of the board. The plug es at the Microbee end, the socket at e output end. When mounting these, lt them to the board before soldering e pins so that no stress is placed on the ldered joints.

After a careful check, you're ready to .



LLIST solver

So, if you are having trouble driving that fancy high quality printer with your 'Bee then check the actual line input printers available that are quite happy to work with only positive-going signals, but occasionally there will be a finicky one that insists on true RS232 levels — in that case, bring out your "Fair Dinkum RS232er".

HOW IT WORKS — ETI 676

The recipe is simple: take one positive supply rail (from Microbee), regulate it then invert it to provide a negative rail, too. Take common-or-garden NPN/PNP transistor pair and switch TxD signal between positive and negative rails without inversion, Voila — true RS232!

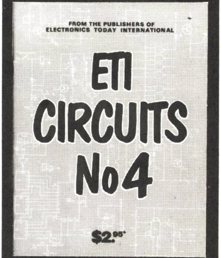
A regulated positive supply rail is supplied by zener ZD1 from the Microbee's internal supply rail (which is around 10 V with a bit of ripple onit). Capacitor C1 provides bypassing.

The negative supply rail is developed by ICl, an Intersil ICL7660 CMOS switching inverter which transfers charge from the positive rail to C2 then in opposite polarity to C3 via D1. The diode is included on the manufacturer's advice to prevent possible destructive latchup of ICl.

The incoming TxD signal from the Microbee is first inverted by Qi, the collector current of which drives the base of Q2 via R4. The emitter of Q2 goes to the unit's positive supply rail, while its collector load (R5) goes to the unit's negative supply rail and thus the TxD signal at the collector of Q2 swings both positive and negative. Resistor R5 provides a measure of protection to the circuit should the output he inadvertently short-circuited.

OVER 200!

circuits and ideas culled from the 'Ideas for Experimenters' pages of ETI's Australian and British editions.



ETI CIRCUITS No. 4

contains a wide range of circuits, ideas and data for the electronics enthusiast, arranged in 15 categories, including: Alarms, Audio, Computers, Games, Triggering & Switching, Techniques, RF and Test & Measurement.

$2.95

Available from newsagents, selected electronic suppliers or direct from ETI Magazine, P.O. Box 227, Waterloo NSW 2017. Please add $1.00 for post and handling if buying by mail.

The George Brown Electronics Group.

Protronics
SOUTH AUSTRALIA
(08) 212 3111
Telex AA88261

George Brown & Co.
VICTORIA
(03) 419 3355
Telex AA35886

George Brown & Co.
SYDNEY
(02) 519 5855
Telex AA21732

Protronics
WESTERN AUSTRALIA
(09) 362 1044
Telex AA93883

George Brown & Co.
NEWCASTLE.
(049) 69 6399
Telex AA28461

George Brown & Co.
A.C.T.
(062) 80 4355
Telex AA62128

Reasons to buy SPI

HC/HCT HIGH SPEED CMOS

1. 74HC00
2. 74HC02
3. 74HC04
4. 74HC08
5. 74HC10
6. 74HC11
7. 74HC12
8. 74HC14
9. 74HC20
10. 74HC27
11. 74HC30
13. 74HC42
14. 74HC73
15. 74HC74
16. 74HC75
17. 74HC76
18. 74HC77
19. 74HC80
20. 74HC82
21. 74HC83
22. 74HC85
23. 74HC86
24. 74HC90
25. 74HC93
26. 74HC107
27. 74HC109
28. 74HC112
29. 74HC113
30. 74HC125
31. 74HC126
32. 74HC132
33. 74HC133
34. 74HC138
35. 74HCT138
36. 74HC139
37. 74HCT139
38. 74HC147
39. 74HC148
40. 74HC151
41. 74HC153
42. 74HC157
43. 74HC158
44. 74HC160
45. 74HC161
46. 74HC162
47. 74HC163
48. 74HC164
49. 74HC165
50. 74HC167
51. 74HC173
52. 74HC174
53. 74HC175
54. 74HC176
55. 74HC177
56. 74HC182
57. 74HC192
58. 74HC193
59. 74HC194
60. 74HC195
61. 74HC238
62. 74HC239
63. 74HC240
64. 74HCT240
65. 74HC241
66. 74HCT241
67. 74HC242
68. 74HC244
69. 74HCT244
70. 74HCT245
71. 74HC251
72. 74HC253
73. 74HC257
74. 74HC258
75. 74HC266
76. 74HC273
77. 74HC280
78. 74HC298
79. 74HC365
80. 74HC367
81. 74HC373
82. 74HCT373
83. 74HC374
84. 74HCT374
85. 74HC393
86. 74HCT502
87. 74HC533
88. 74HC534
89. 74HC540
90. 74HCT540
91. 74HC541
92. 74HCT541
93. 74HC573
94. 74HCT573
95. 74HC574
96. 74HCT574
97. 74HCT670
98. 74HC4002
99. 74HC4017
100. 74HC4020

101.

WE DELIVER THE FIRST 100 REASONS.

SPI Solutions in Silicon

The George Brown Electronics Group.

Protronics
SOUTH AUSTRALIA
(08) 212 3111
Telex AA88261

George Brown & Co.
VICTORIA
(03) 419 3355
Telex AA35886

George Brown & Co.
SYDNEY
(02) 519 5855
Telex AA21732

Protronics
WESTERN AUSTRALIA
(09) 362 1044
Telex AA93883

George Brown & Co.
NEWCASTLE.
(049) 69 6399
Telex AA28461

George Brown & Co.
A.C.T.
(062) 80 4355
Telex AA62128

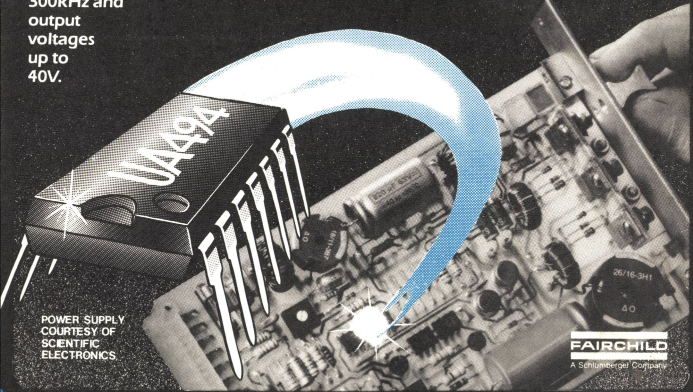
REGULATORS

The more efficient µA494.

The µA494 is a monolithic integrated circuit which includes all the necessary building blocks for the design of pulse width modulated switching power supplies, including push-pull, bridge and series configurations. The device can operate at switching frequencies between 1.0kHz and 300kHz and output voltages up to 40V.

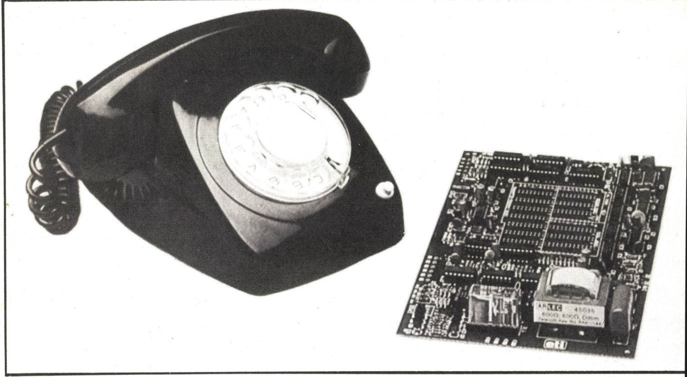
µA431 Does it All!

The µA431 is a 3-terminal Adjustable Shunt Regulator with guaranteed temperature stability over the entire temperature range of operation. The output voltage may be set at any level greater than 2.5V up to 36V merely by selecting two external resistors that act as a voltage divided network. Due to the sharp turn-on characteristics this device is an excellent replacement for many zener diode applications.



POWER SUPPLY
COURTESY OF
SCIENTIFIC
ELECTRONICS

FAIRCHILD
A Schlumberger Company



Direct-connect computer modem revision

The ETI-644A pc board is a revised version of the original computer modem which allows communications between computers over cables, the telephone network or radio links.

Geoff Nicholl

THE DIRECT-CONNECT MODEM project, ETI-644 (shown above), was designed by Trevor Marshall and the description and construction techniques were published in ETI, October 1982.

It was a very popular project but, as the many people who tried to build it found out, there were a few problems. So we published an errata for the modem in ETI, April 1983. And that's not all. A follow-up article appeared in ETI, November 1983, with lots of advice from the designer and a successful constructor.

However, we realised that it was not an ideal situation for constructors to have to make changes to the pc board and we have been planning to issue a revised pc board incorporating all the previous modifications. So, here it is.

The ETI-644A (hopefully) does not have the errors that were on the first version and it includes some other changes so that it conforms more closely to the Telecom requirements. This new board also allows a choice of isolation transformers.

If you are modifying the original pc board, or working on the revised version, you will need to refer back to the follow-up articles and, of course, the first article detailing the design and construction.

Modifications

The errors corrected on the original version involve three areas of the circuit:

1. Rerouting the track to C31 to conform to the circuit.

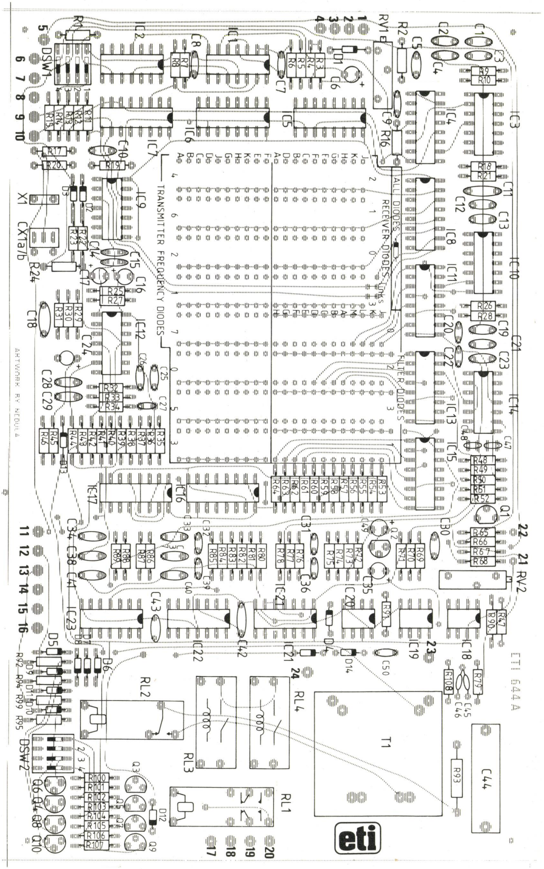
2. Changing the tracks around IC12a to conform to the circuit.

3. Running R48 to 0 V, not −6 V.

The first and third changes were published in the errata in ETI, April 1983, and the modem follow-up article in ETI, November 1983. The second change has never been clearly explained before, due to a communication problem (the designer lives in California). If you have one of the original pc boards these modifications should be made by cutting tracks and running links.

- C44 has been moved.
- R93 has been moved.
- The isolation transformer pads ha been extended to allow a choice betwe the Arlec 45035 transformer, as in t original modem, or the new Fergus MT627 which we believe is less expensiv The position of the transformer has n been changed.
- RL1 has been moved towards the boa edge.
- RL2 has changed to FBR611D012.
- RL3 and RL4 have been moved u wards.
- D12 has been moved.
- R96, R97 and R98 have been delete therefore 12 V relay coils must be used f RL1,2,3,4.

Some resistors and transistors associat with RL3 and RL4 have been inte changed so that the DIL switches and t relay drive input pads will be the same the earlier board. These labels have be transposed: R95↔R99, D10↔D1 Q6↔Q4.


TRANSMITTER FREQUENCY DIODES
RECEIVER DIODES
ALL DIODES
LINKS
FILTER DIODES
ARTWORK BY MEGRA A
ETI 644A
RV1
RV2
DSW1
DSW2
X1
CX1a/b
T1
RL1
RL2
RL3
RL4
C44
R93
IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
IC9
IC10
IC11
IC12
IC13
IC14
IC15
IC16
IC17
IC18
IC19
IC20
IC21
IC22
IC23
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
eti

Information Explosion!

If you're really into electronics....
you'll be into the ETI Collection

TEST GEAR VOLUME 2
Having the right test equipment helps you tackle complex projects with confidence. With the right test equipment you can fault-find troubleshoot and analyse the projects you build and gain a greater knowledge of the circuitry and techniques employed. Projects include: a sound level meter, audio spectrum analyser, true RMS voltmeter, capacitance meter, RF signal generator a dc power supply and more. 114 pages.
$4.95 plus $1.00 postage and handling.

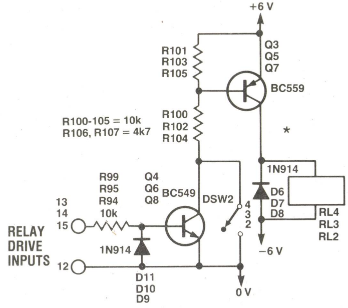
TOP PROJECTS VOLUME 6
A collection of more than 25 popular ETI projects, including: the Series 4000 amplifier, moving-coil preamplifier and four-way loudspeaker, speaker protection unit, remote control transmitter and receiver, guitar practice amplifier and a simple intercom.
$4.95 plus $1.00 postage and handling.

HOW TO ORDER: If you cannot find the book or books you want at your local newsagent or electronics supplier, you may order direct from ETI. Fill in the coupon, enclose a cheque or money order (don't forget to include postage) and send it to:

ETI Collection Electronics Today Magazine
140 Joynton Ave., Waterloo. NSW 2017

Please send me (put X in box)
☐ TEST GEAR VOLUME 2
☐ TOP PROJECTS VOLUME 6

Name ....
Address ....
.... Postcode ....
I enclose $ ....(inc. p. & h.).



Line interface relay drivers. *Note that R96, R97 and R98 have been removed.

The changes made around the line wiring increase the spacing between the line side and user side tracks to 5 mm minimum, in accordance with Specification 1302, Section 15.7.

This section also calls for a minimum of 15 mm between wiring components and their pigtails on either side of the line interface. This requirement is not completely met, however, it may be possible to satisfy the inspectors by encapsulating the offending terminals with a suitable insulating compound.

The only *essential* construction changes are that insulated pc mounts **must** be used — either nylon bolts and nuts or plastic stand-offs — and all relays must have 12 V coils.

The usual practise is to provide a pair of back-to-back zener diodes across the user side of the isolation transformer to comply with Specification 1302. However, it is our opinion that the use of a type-approved plug pack for the power supply (as in the ETI-644) means that the entire user circuit is at a safe extra-low voltage and so no further limiting devices are necessary. This argument has *not* been put to Telecom, however, and we make no claim regarding its acceptance.

The ETI-644 and Telecom

The Telecom regulations, as we understand them, mean that any 'kit' modem will have to be individually submitted for approval and that no type-approval is possible. This is, of course, a sensible approach by Telecom since the standard of workmanship by individual constructors is unknown.

However, there may be a way for a
supplier to get type-approval, providi
that the line interface and power supp
components can be pre-assembled in
way that satisfies Telecom, leaving or
the user side for the constructor to asse
ble.

Another approach would be to use
type-approved line isolation unit betwe
the modem and the Telecom line. I do
know of any suppliers of such units, but
is a way to get authorisation without ha
ing to submit a modem.

You should refer to the legislation co
cerning modems which was summarised
page 26 of ETI, October 1982.

TELECOM SPECIFICATIONS

To the best of our knowledge, no-one has go
through the approval process neccessary to g
authorisation from the Regulatory Branch of Te
com. This is not surprising, considering the amo
of paperwork (and legwork) required.

The relevant documents that Telecom issue ar

1. Specification 1240 Issue 2 *Attachment of P*
vately Owned Data Modems to the Telecommu
cations Network.

2. Specification 1302 *Electrical Safety Requi*
ments for Permitted Attachments.

3. Specification 1364 *Line Isolation Units.*

4. Specification 1050 *Attachment of Private Equ*
ment to the Telecommunications Network, Gene
Conditions.

5. Specification 1053 *Attachment of Private Equ*
ment to the Switched Telephone Network, Tech
cal Conditions.

6. Specification 1054 *Attachment of Private Equ*
ment to Private Telephone Lines, Technical Con
tions.

7. Specification 1222 *Use of Type 604/611 P*
and Socket.

You rotting swine!
— a compost calculator

If you're into gardening, or someone around your house is, and you own a computer — here's how to combine two disparate activities and maybe win friends and influence plants at the same time.

Joe Kenyon

ERE IS a down to earth 'basic' program
yone can use to quickly make sweet
nelling, nutritious (for the garden) com-
ost, completely rotted in three weeks,
d help beat the high price of vegetables.
ut why bother? Well, doom and gloom
em to have gone out of fashion lately,
t the simple fact is that we have to con-
rve our resources to survive. On our dry
ntinent, water and soil are major re-
urces. Composting otherwise wasted ma-
rials will help conserve both water and
il by reducing evaporation and erosion.
Every year we burn or dump thousands
tonnes of organic material which could
economically returned to the soil. In
ew Zealand these materials are com-
osted by councils and the compost sold
ck to growers and householders. There
e similar community composting facili-
s in America. (See April 1983 *National*
eographic magazine.)

We can do our part by composting (not burning or dumping) leaves, grass clippings, paper, and a large variety of other garden and farm products.

Compost is especially useful in home gardens in times of drought due to it's moisture conserving properties, and the fact that it can now be made quickly, just when it is needed. Placed around the trees and vegetables, it will keep the soil cool, even on very hot days, thereby cutting evaporation. Earthworms will come up and mix the compost into the surrounding soil thus raising the level of humus and nutrients and reducing nitrogen loss.

Compost can be:

(a) Quickly made.

(b) Sweet smelling.

(c) Made in the open air without bins or fancy containers.

(d) Made so that all weed seeds, plant pathogens, and even maggots are killed.

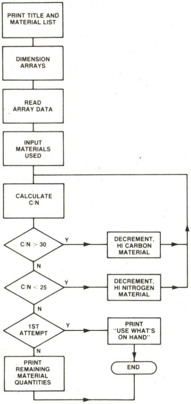
Just what is a compost heap?

It is simply a method of speeding up the natural process of rotting organic materials, in order to return nutrients and humus to the soil. However, a compost heap is also a very complex chemical factory. Till about the fourteenth day after making the heap there are changes continuously occurring in the temperature, pH level, chemical composition and microbiological population. See *Reference 1* if you are interested in a more detailed description of these changes.

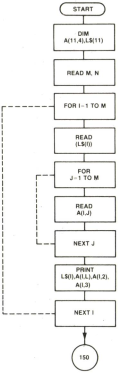
The method described here is called the Berkeley Method and was developed at the University of California, Berkeley. It is the best method of making compost without exception.

The essential elements for this type of compost heap are: ▶

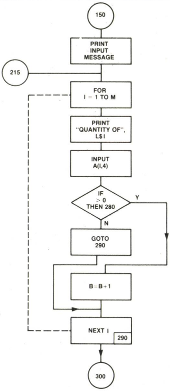
FLOWCHART PRECIS


PRINT TITLE AND MATERIAL LIST
DIMENSION ARRAYS
READ ARRAY DATA
INPUT MATERIALS USED
CALCULATE C/N
C/N > 30
Y
N
DECREMENT, HI CARBON MATERIAL
C/N < 25
Y
N
DECREMENT, HI NITROGEN MATERIAL
1ST ATTEMPT
Y
N
PRINT "USE WHAT'S ON HAND"
END
PRINT REMAINING MATERIAL QUANTITIES

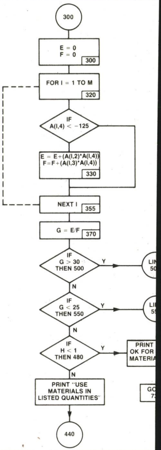
FLOWCHART COMPOST



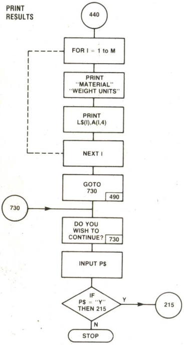
INPUT MATERIALS AND QUANTITIES



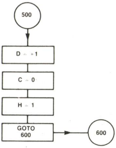
SEARCH ARRAY AND CALCULATE C/N RATIO



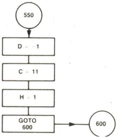
PRINT RESULTS



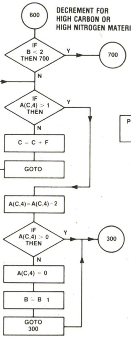
FOR > 30 PROGRAM

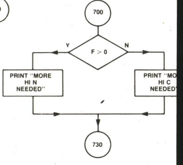


FOR < 25 PROGRAM



DECREMENT FOR HIGH CARBON OR HIGH NITROGEN MATERIAL





VARIABLES:

M, N = ROWS AND COLUMNS OF ARRAY
A(M,N) = DATA ARRAY
B = NUMBER OF MATERIALS COUNTER
C = ROW POINTER
D = 1 OR −1, INCREMENT OR DECREMENT ROW POINT
E = CARBON QUANTITY
F = NITROGEN QUANTITY
G = CARBON/NITROGEN
P$ = YES OR NO

compost calculator

PROGRAM

```
00100 PRINT "COMPOST CALCULATOR - 11 TYPES OF MATERIAL USED"
00110 PRINT "UNITS OF WEIGHT MUST BE CONSISTENT"
00120 READ M
00130 DIM A0(M,4) ,L0(M)
00140 REM....print table of materials & composition.
00150 REM....L0$(x) contains material names
00160 REM....A0(x,1) holds C/N ratios
00170 REM....A0(x,2) holds %C
00180 REM....A0(x,3) holds %N
00190 UNDERLINE
00200 PRINT "MATERIAL"TAB(18)"C/N RATIO"TAB(29)"%CARBON";
00210 PRINT TAB(38)"%NITROGEN"
00220 NORMAL
00230 FOR I=1 TO M
00240 READ L0$(I)
00250 FOR J=1 TO 3
00260 READ A0(I,J)
00270 NEXT J
00280 PRINT L0$(I)TAB(20)A0(I,1)TAB(30)A0(I,2)TAB(40)A0(I,3)
00290 NEXT I
00300 REM....input material amounts into A0(x,4)
00310 REM....B is number of materials used
00320 PRINT "PLEASE ENTER MATERIALS IN WEIGHT UNITS, NONE=0.'
00330 B=0
00340 FOR I=1 TO 11
00350 PRINT "QUANTITY OF "L0$(I);
00360 INPUT A0(I,4)
00370 IF A0(I,4)>0 THEN LET B=B+1
00380 NEXT I
00390 REM....multiply amounts by percentages to total C & N
00400 E0=0:F0=0
00410 FOR I=1 TO M
00420 E0=E0+(A0(I,2)*A0(I,4))
00430 F0=F0+(A0(I,3)*A0(I,4))
00440 NEXT I
00450 REM....calculate G0 the overall C/N ratio
00460 G0=E0/F0
00470 REM....if C/N is within range print out table,
00480 REM....otherwise, jump to readjust amounts.
00490 IF G0>30 THEN LET D=1:C=1:GOTO 600
00500 IF G0<25 THEN LET D=-1:C=11:GOTO 600
00510 UNDERLINE
00520 PRINT "MATERIAL","WEIGHT UNITS"
00530 NORMAL
00540 FOR I=1 TO M
00550 PRINT L0$(I)TAB(18)A0(I,4)
00560 NEXT I
00570 PRINT "C/N RATIO="G0" THIS IS OK FOR GIVEN MATERIALS"
00580 GOTO 720
00590 REM....adjust material amounts to get C/N within range
00600 IF B<2 THEN 690
00610 IF A0(C,4)>=1 THEN 640
00620 C=C+D
00630 GOTO 610
00640 A0(C,4)=A0(C,4)-2
00650 IF A0(C,4)>0 THEN 400
00660 A0(C,4)=0
00670 B=B-1
00680 GOTO 400
00690 IF D>0 THEN 740
00700 PRINT "C/N CANNOT BE RAISED ABOVE ";G0;"UNLESS"
00710 PRINT "MORE HIGH CARBON MATERIALS ARE ADDED"
00720 PRINT "DO YOU WISH TO CONTINUE? (Y=YES)";
00730 INPUT P0$:IF P0$="Y" OR P0$="y" THEN 330 ELSE STOP
00740 PRINT "C/N CANNOT BE REDUCED BELOW ";G0;"UNLESS"
00750 PRINT "MORE HIGH NITROGEN MATERIALS ARE ADDED"
00760 GOTO 720
00770 REM....to add extra materials to data table,
00780 REM....increase fist entry i.e.'11'
00790 DATA 11,"SAWDUST",450,34,.08,"PAPER",170,36,.2
00800 DATA "STRAW",100,36,.4,"LEAVES",60,24,.4
00810 DATA "FRUIT WASTE",35,8,.2,"LAWN CLIPPINGS",20,6,.3
00820 DATA "WEEDS",19,6,.3,"FOOD WASTES",15,8,.5
00830 DATA "CATTLE DROPPINGS",12,30,1.7
00840 DATA "CHICKEN LITTER",10,25,2.5
00850 DATA "FOWL MANURE",7,30,4.3
00860 END
```

THE PROGRAM

Geoff Nicholls has re-worked the author's original program into Microworld BASIC (Microbee). Other machines running BASIC may require modifications to suit the particular version of BASIC employed. Note hat the program will adjust the weights of materials initially entered to chieve the desired result (see the sample runs).

SAMPLE RUN

```
>RUN

COMPOST CALCULATOR - 11 TYPES OF MATERIAL USED
UNITS OF WEIGHT MUST BE CONSISTENT
MATERIAL         C/N RATIO  %CARBON  %NITROGEN
SAWDUST             450.      34.       0.08
PAPER               170.      36.       0.2
STRAW               100.      36.       0.4
LEAVES              60.       24.       0.4
FRUIT WASTE         35.       8.        0.2
LAWN CLIPPINGS      20.       6.        0.3
WEEDS               19.       6.        0.3
FOOD WASTES         15.       8.        0.5
CATTLE DROPPINGS    12.       30.       1.7
CHICKEN LITTER      10.       25.       2.5
FOWL MANURE         7.        30.       4.3
PLEASE ENTER MATERIALS IN WEIGHT UNITS, NONE=0.
QUANTITY OF SAWDUST? 5
QUANTITY OF PAPER? 0
QUANTITY OF STRAW? 10
QUANTITY OF LEAVES? 0
QUANTITY OF FRUIT WASTE? 0
QUANTITY OF LAWN CLIPPINGS? 20
QUANTITY OF WEEDS? 0
QUANTITY OF FOOD WASTES? 0
QUANTITY OF CATTLE DROPPINGS? 0
QUANTITY OF CHICKEN LITTER? 5
QUANTITY OF FOWL MANURE? 5
MATERIAL       WEIGHT UNITS
SAWDUST           5.
PAPER             0.
STRAW             10.
LEAVES            0.
FRUIT WASTE       0.
LAWN CLIPPINGS    20.
WEEDS             0.
FOOD WASTES       0.
CATTLE DROPPINGS  0.
CHICKEN LITTER    5.
FOWL MANURE       1.
C/N RATIO= 29.595588 THIS IS OK FOR GIVEN MATERIALS
DO YOU WISH TO CONTINUE? (Y=YES)? Y
QUANTITY OF SAWDUST? 5
QUANTITY OF PAPER? 0
QUANTITY OF STRAW? 10
QUANTITY OF LEAVES? 0
QUANTITY OF FRUIT WASTE? 0
QUANTITY OF LAWN CLIPPINGS? 20
QUANTITY OF WEEDS? 0
QUANTITY OF FOOD WASTES? 0
QUANTITY OF CATTLE DROPPINGS? 0
QUANTITY OF CHICKEN LITTER? 0
QUANTITY OF FOWL MANURE? 10
MATERIAL       WEIGHT UNITS
SAWDUST           5.
PAPER             0.
STRAW             10.
LEAVES            0.
FRUIT WASTE       0.
LAWN CLIPPINGS    20.
WEEDS             0.
FOOD WASTES       0.
CATTLE DROPPINGS  0.
CHICKEN LITTER    0.
FOWL MANURE       4.
C/N RATIO= 27.89855 THIS IS OK FOR GIVEN MATERIALS
DO YOU WISH TO CONTINUE? (Y=YES)? Y
QUANTITY OF SAWDUST? 10
QUANTITY OF PAPER? 0
QUANTITY OF STRAW? 0
QUANTITY OF LEAVES? 0
QUANTITY OF FRUIT WASTE? 20
QUANTITY OF LAWN CLIPPINGS? 0
QUANTITY OF WEEDS? 5
QUANTITY OF FOOD WASTES? 0
QUANTITY OF CATTLE DROPPINGS? 0
QUANTITY OF CHICKEN LITTER? 0
QUANTITY OF FOWL MANURE? 0
MATERIAL       WEIGHT UNITS
SAWDUST           0.
PAPER             0.
STRAW             0.
LEAVES            0.
FRUIT WASTE       6.
LAWN CLIPPINGS    0.
WEEDS             5.
FOOD WASTES       0.
CATTLE DROPPINGS  0.
CHICKEN LITTER    0.
FOWL MANURE       0.
C/N RATIO= 28.888888 THIS IS OK FOR GIVEN MATERIALS
```

(1) Overall, the carbon-to-nitrogen ratio must be between 25:1 and 30:1;

(2) The heap must be well aerated;

(3) The heap must be kept just moist;

(4) It should be about a cubic metre for convenience;

(5) It must be exercised.

Carbon-to-nitrogen ratio

All garden materials contain some carbon and some nitrogen. The compost heap must have an overall ratio of between 25:1 and 30:1 carbon to nitrogen by weight to work correctly. Too much carbon and microbiological activity is reduced, too much nitrogen means loss of valuable nitrogen in the form of ammonia.

Aeration

If the heap is provided with plenty of oxygen the growth of aerobic bacteria will be promoted, and the heap will rot quickly and be sweet smelling. It is the anaerobic bacteria which cause the foul odours for which compost heaps have been known in the past.

Aeration is achieved by siting the heap on an open base such as a plantform of loosely fitted wooden planks, and by turning. More about turning later.

Moisture content

The moisture content of a compost heap should be about 50 to 55 per cent. below about 40 per cent, organic material will not decompose quickly enough. Above 60 per cent, the heap becomes anaerobic and may start issuing foul odours. The moisture content required is about the same as a squeezed sponge, damp but not soggy.

Correct size of heap

The best size for your compost heap is between half and two cubic metres. It is difficult to control temperature rise in heaps larger than two metres without mechanical aids. A heap smaller than half a cubic metre may not work. Particularly in cold weather.

Chopping up the materials to lengths of one to ten centimetres speeds decomposition by increasing the surface area available to the micro-organisms. If you have a garden shredder it is easy to cut garden rubbish finely enough. The job can also be done by running a mower over the weeds and light prunings, etc. Grass clippings can be used directly.

Exercise

This is where the real objections to compost come in: Turning the heap. This needs to be done about every four days for two weeks. Turning the heap has been looked on in the past as a backbreaking task, and so it is, if you use your back. This is not necessary. The heap can be turned by rolling, not lifting. This is best done with a vine hoe, but a garden rake will do.

Using the hoe, dig into the top of the heap, pull it towards you and form a new heap at your feet. The heap is thus turned upside down with very little effort and turned upside down with very little effort and aerated at the same time.

No garden plants need be burnt, even diseased plants can be chopped up and put into the heap. Plant pathogens will be killed provided all materials spend some time in the centre of the heap where it is hottest.

How to make a compost heap

Just follow the steps:

(1) Collect organic materials into separate heaps. See the table for ideas on materials.

(2) Ascertain total weight of each type of material, method as below:

(a) Fill one plastic bucket of any convenient size with material to be weighed;

(b) Weigh on kitchen scales, and note weight. (Careful with that manure, better do it outside. Partners are not impressed by manure on floor. I know.);

(c) Dump the weighed bucketful beside the appropriate heap. Then, estimate by eye the number of bucketsful in that heap. Simply multiply bucketsful by noted weight for one bucketful, to find total weight of that material. This method is sufficiently accurate and becomes more so with practice.

(3) Calculate the carbon/nitrogen ratio.

The formula is below.

$$C/N = \frac{(W1 \times C1) + (W2 \times C2) + \ldots\ldots (WN + CN)}{(W1 \times N1) + (W2 \times N2) + \ldots\ldots (WN + NN)}$$

C/N is carbon to nitrogen ratio.

W1 . . . WN are weight units of materials 1 to N.

C1 . . . VN are carbon percentages for materials 1 to N.

N1 to NN are nitrogen percentages for materials 1 to N.

N1 to NN are nitrogen percentages for materials 1 to N.

TABLE 1: approximate composition of some organic materials

MATERIAL	C/N RATIO	gC/100g	gN/100g
Lawn clippings	20	6	0.3
Weeds	19	6	0.3
Leaves	60	24	0.4
Paper	170	36	0.2
Fruit wastes	35	8	0.2
Food wastes	15	8	0.5
Sawdust	450	34	0.08
Chicken droppings	7	30	4.3
Chicken litter	10	25	2.5
Straw	100	36	0.4
Cattle droppings	12	20	1.7

The table gives approximate composition of eleven organic materials.

Suppose we have on hand 2 kg o leaves, 1 kg of sawdust and 2.5 kg of cattle droppings. Weight ratios = 2:1:2.5

$$C/N = \frac{(2 \times 24) + (1 \times 34) + (2.5 \times 20)}{(2 \times 0.4) + (1 \times 0.08) + (2.5 \times 1.7} = 2$$

This formula works quite well if the C/ ratio comes out between 25:1 and 30:1 th first time. If it does not then you mus change the quantities and try again . . and again . . . etc. This is where the program comes in. It will input the amount of materials on hand and adjust quantitie to achieve the correct C/N ratio. It wi then print out the quantities you shoul use and the C/N ratio which would b achieved.

(4) Mix materials together, moistenin slightly, drag with rake or hoe, don't lif Adding a small amount of soil or old compost to the mixture will help ensure th presence of bacteria to start the process.

(5) Turn/roll the heap about every fou days for two weeks or so.

Go to it

Many people are turning to home-grow foods to avoid artificial fertilizers and pe ticides. Kitchen and garden wastes ca build first class soil, when handled properly. First class soil grows superb veget bles with flavour you have not exper enced since childhood (if at all!). With th program you can generate correctly ba anced sweet smelling compost in thre weeks.

The table can be used to help in the in tial selection of material. *Have a rottin time, won't you now . . .*

REFERENCES

(1) *Composting: Making Soil Improv From Rubbish.* Kevin Handreck, Disco ering Soils No. 3, CSIRO Division Soils.

(2) *National Geographic* magazine, Ap 1983.

(3) *Composting: A Study of the Proce and its Principles.* C. G. Golueke, 197 (Rodale Press).

(4) *The Biochemistry and Methodology Composting.* R. P. Poincelot, Connectic Agricultural Experiment Station. Bullet 727, 1972.

(5) *A Scientific Examination of the Princ ples and Practice of Composting.* R. Poincelot, Compost Science Vol. 1 No. 3 pages 24 to 31 (1974).

(6) *Farmers of Forty Centuries.* F. King, 1911 (Rodale Press).

(7) *Compost Science* (Rodale Press). A b monthly journal containing many articl about compost making and other issues related to the recycling of resources.

(8) *Soil Organic Matter and its Role Crop Production.* F. E. Allison, 197 (Elsevier).

(9) *Garbage as you like it.* J. Goldstei 1970 (Rodale Press).

(10, 11) *The Garden Compost Heap, Pa 1 and 2* by K. Gray and A. Biddlestone the British Journal *The Garden* Volum 101, November and December, 1976, p 540-4; 594-8.

WHAT'S NEW AT ROD IRVING ELECTRONICS

Ritron 11 Monitors are now available to increase our range of Data Displays. They feature a unique adjustable swivel base that tilts forward or back 30 degrees and swivels right to left 60 degrees.

Technical specifications are listed below:

SPECIFICATIONS
CRT SIZE
12 inches non-glare 90 degree deflection
INPUT SIGNAL
1.0 – 2.5V p-p composite video signal
INPUT INPEDANCE
Normal 75 ohm, high approx. 50K ohm
INPUT TERMINALS
RCA phone jack
RISE TIME AND FALL TIME
Less than 25 us
VIDEO BANDWIDTH
20 MHz + – 3dB
SCANNING FREQUENCY
Horizontal : 15.75 KHz + – 0.5 KHz
Vertical : 50 Hz/60 Hz
Horizontal Retrace Time : Approx 8.5 us
Vertical Retrace Time : Approx 800 us
PHOSPHORS AVAILABLE
Amber, Green
RESOLUTION
Centre : 1000 Lines
Corner : 800 Lines
Geometric distortion : 2% or less
Linearity : less than 2%
CONTROLS
Front: POWER ON/OFF, brightness contrast
Rear : V-Hold H-Hold V-Line V-Size

AVAILABILITY: Green Phosphor in Stock **$220.00**
Amber Phosphor Early March **$249.00**

SCHOOL AND DEALER ENQUIRIES WELCOME

APPLE COMPATIBLE DISK DRIVE

Super 5 SPECIFICATIONS

HIGH-SPEED ACCESS, HIGH ACCURACY POSITIONING Instead of plastic CAM positioner or lead screws positioner, a high microprecision metal band positioner is adopted in the mechanism to position the head.

BRUSHLESS DC DIRECT-DRIVE MOTOR Direct drive means that there is no improper belt seating, so the variations in speed and friction-producing side loading can be eliminated, which allows motor running lifetime to be over 10,000 hours.

MOTOR'S CLOSED LOOP SERVO Hall effect devices are utilized as speed control sensor in DC motor system, so motor can run stably and accurately.

SLIM, HALF-HEIGHT DRIVE The disk drive is only 41 mm high, it is only half the size of conventional models.

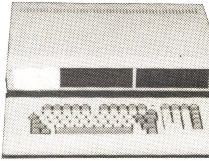
NO CONTACT WRITE-PROTECTED SENSOR Photo coupler is used as write-protected sensor. It means no damage, long lifetime and good reliability for disk media.

GENERAL SPECIFICATIONS

Capacity (formatted)	163K (20K bytes more than the original).
No. of tracks:	40 tracks (5 tracks more).
No. of sectors track:	13 or 16 sectors.
Disk rotation speed:	300 rpm.
Track density:	48TPI.
Track to track time:	Less than 6 msec.

DO YOUR NEED A CASE FOR A SINGLE BOARD COMPUTER

This stylistic low profile case will give your system the professional look it needs. This case comes complete with an encoded, parallel output keyboard. The keyboard is in it's own case attached via a coiled connector, so it can be placed for maximum comfort. Sit one of our new swivel monitors on top and make your system look like it's worth thousands.



NEW CS1000 PRINTER

Has a 9 × 11 matrix, working speed of 100 chrs/sec, parallel and serial interfaces as standard, logic seeking head, and superb graphics. This is the big brother of our famous CP80.

ONLY 695.00 INC TAX

CASE AND ENCODER KEYBOARD $299.00

Tax Ex $249.00

Software from our computer division C-TECH

MICROBEE SOFTWARE FROM MYTEK

PROGRAM	PRICE
Asteroid Plus	$22.50
Backgammon	$17.50
Basic Tutorial	$20.00
BeeZ80	$20.00
Chopper	$20.0
Composer Bee	$20.00
DeBug	$17.50
Defender	$22.50
Emu Joust	$17.50
Kilopede and Ghost Muncher	$20.00
King Kong	$20.00
Logo Bee	$22.50
Machine Code Tutorial	$25.00
Meteor Rescue	$17.50
MusicB	$20.00
Tape Doctor	$17.50
Touch Type Tutorial	$20.00
TRSBee	$30.00
Wordprocessing Cassette	$35.00
Wordprocessing Chip	$39.00

DREAMCARDS

PROGRAM	PRICE
Poker/Casino	$14.95
Squirm/Toad	$14.95
Adventure Pak: Hyperdrive/Caverns	$19.95
Millipedes/Maze	$14.95
Decide/Hiroller	$14.95
Penetrator	$19.95
Merlin	$24.95
Mine Drop	$14.95
Psychotec	$14.95
Killer Bees (32K only)	$14.95
Disassembler	$14.95
Cheapie	$14.95
Physics Pac 1	$34.95

OZI SOFT SOFTWARE COMMODORE 64

PROGRAM	PRICE
Super Skramble	$24.95
Snakman 64	$29.95
Super Dogfight	$24.95
Super Gridder	$24.95
Grave Robbers	$19.95
Annihilator 64	$24.95
Abracalc Disk	$49.95
Abracalc Cassette	$45.95
Home Manager Disk	$39.95
Home Manager Cassette	$34.95
Monkey Math 64	$29.95
Bug Blast 64	$19.95
Spelling Time	$16.95
Geography Time	$19.95
Maths Time	$19.95
Reading Time	$19.95
Typing Tutor	$19.95
Master File 64	$39.95 (disk)
Glaxions 64	$19.95
Munchman 64	$19.95
Adventure Pak 64	$24.95
Metamorphosis 64	$19.95
Kongo Kong 64	$24.95

ROD IRVING ELECTRONICS
425 High St., Northcote, Vic. 48-50 A'Beckett St., Melb., Vic.
Phone (03) 489 8866, (03) 489 8131, Mail Order Hotline (03) 481 1436
Mail orders to P.O. Box 235 Northcote 3070 Vic.

Minimum P & P $3.00. Errors & omissions excepted.
Please address tax exempt, school, wholesale and dealer enquiries

RITRONICS WHOLESALE
1st floor 425 High St. Northcote 3070 (03) 489 7099 (03) 481 1923
Telex AA 38897

HI-RES SCREEN TO PRINTER DUMP

Geoffrey Tyerman, Sutherland NSW

This machine code program will dump both hi-res graphics and standard ROM characters from a Microbee computer to an Epson or compatible code printer. It will dump in one of two modes: single density (start address SINDEN) or double density (start address DOUDEN).

The program forms data for the printer in a 8 x 1 dot vertical bar. To produce one Microbee line the printer must make two passes of each line (one Microbee line consists of 16 vertical dots). These two lines are labelled 'top' and 'bottom'. The program stores various program counters/variables in memory locations 10 — 1B (hex).

In order to generate data for the standard character set, the program must read the character ROM. The character ROM is located at memory lcoation F000 — F7FF hex. Yes! This is the same address as the screen address, but to read the character ROM you have to latch it on by using port 11 decimal or B hex.

e.g: to latch on ROM
LD A,1
OUT (OBH),A
to latch off ROM
LD A,0
OUT (OBH),A

If you are going to use this program as a sub routine be sure to save the register values fror previous routines as this program destroys mos registers.

HI-RES SCREEN TO PRINTER DUMP

```
ADDR  CODE   LINE   LABEL  MNEM  OPERAND

             00100 ;
             00110 ;       HIRES   HORIZONTAL   PRINTER   SCREEN   DUMP
             00120 ;
             00130 ;       created  by  Geoffrey  Tyerman   1983
             00140 ;
             00150 ;
             00160 ;
             00165 *L OFF
             00197 *L ON
0010         00200 CURR1    EQU   10H       ;top part of line counter
0012         00210 CURR2    EQU   12H       ;bottom part of line counter
0014         00220 LINE     EQU   14H       ;line counter
0015         00230 TOPBOT   EQU   15H       ;top or bottom part of line
0016         00240 CHARCT   EQU   16H       ;character counter
0040         00250 CHAR     EQU   40H       ;no of characters per line
0017         00260 DOT      EQU   17H       ;current dot/column in char.
001B         00270 DATA     EQU   18H       ;pcg/rom location data storage
001A         00280 MODE     EQU   1AH       ;mode - single or double density
             00300 ;
             00310 ;
             00900 ;  SINGLE DENSITY START
0400 3E01    00910 SINDEN  LD       A,1
0402 1801    00930         JR       START
             00940 ;  DOUBLE DENSITY START
0404 AF      00950 DOUDEN  XOR      A        ;  load 'A' with 0
0405 321A00  00960 START   LD       (MODE),A
             01000 ;
             01010 ; initalize  routine
             01020 ;
0408 2100F0  01030 INITAL  LD    HL,0F000H        ;start of dump location
040B 221000  01040         LD    (CURR1),HL       ;  (  screen  )
040E 221200  01050         LD    (CURR2),HL
0411 3E10    01060         LD    A,10H            ;no. of lines
0413 321400  01070         LD    (LINE),A
0416 3E00    01080         LD    A,0
0418 321500  01090         LD    (TOPBOT),A       ;init topbot to top
041B 211105  01095 INITLF  LD    HL,LF   ;init. printer LF to 16/244 "
041E CD1F05  01096         CALL  PRINTR  ;routine to send data to printer
0421 3E40    01105 LINSTR  LD    A,CHAR
0423 321600  01110         LD    (CHARCT),A       ;no. CHAR per line
0426 3E07    01120         LD    A,7              ;bits per char 0-7
0428 321700  01130         LD    (DOT),A
042B 3A1A00  01140         LD    A,(MODE)         ;ld 'A' with mode
042E B7      01150         OR    A                ;test for single
042F 2005    01151         JR    NZ,SINGLE        ;single density
0431 211A05  01152         LD    HL,DD            ;double density data
0434 1803    01160         JR    CONTI
0436 211505  01170 SINGLE  LD    HL,SGD           ;single density data
0439 CD1F05  01180 CONTI   CALL  PRINTR           ;load printer with data
             01200 ; find char at current line
             01210 ;
043C 211500  01220 FINDCH  LD    HL,TOPBOT
043F CB46    01230         BIT   0,(HL)
0441 2805    01240         JR    Z,TPLNCH         ;top line char
0443 2A1200  01250         LD    HL,(CURR2)
0446 1803    01260         JR    LDA
0448 2A1000  01270 TPLNCH  LD    HL,(CURR1)
044B 7E      01280 LDA     LD    A,(HL)           ;current char in 'A'
             01390 ;
             01400 ; find data for char (pcg)
             01410 ;
044C 0604    01420 FINDDT  LD       B,4
044E 5F      01430         LD       E,A
044F 1600    01440         LD       D,0      ;load de with a
0451 B1      01450         OR       C        ;clear carry
0452 CB13    01460 ROTATE  RL       E
0454 CB12    01470         RL       D
0456 10FA    01480         DJNZ     ROTATE   ;rotate 4 times
0458 2100F0  01481         LD       HL,0F000H
045B 19      01482         ADD      HL,DE    ;add to find char data loc.
045C 221800  01490         LD       (DATA),HL
             01590 ;
             01600 ;find print data
             01610 ;
045F 211500  01620 FINDPD  LD       HL,TOPBOT
0462 0608    01625         LD       B,8      ;no. of bits to test
0464 CB46    01630         BIT      0,(HL)   ;is top or bot set
0466 2A1800  01635         LD       HL,(DATA)
0469 2804    01640         JR       Z,PNDT
046B 110800  01650         LD       DE,8
046E 19      01660         ADD      HL,DE    ;find data for sec line
```

```
ADDR  CODE   LINE   LABEL   MNEM    OPERAND

046F 3E01    01670 PNDT     LD      A,1
0471 D30B    01680          OUT     (0BH),A   ;latch char rom.
0473 1E00    01685 LOPE     LD      E,0
0475 CDD904  01690 LOPBIT   CALL    TSTBIT    ;test current bit & ret
0478 2003    01700          JR      NZ,ISSET          ;bit is set
047A B1      01710          OR      C         ;clear carry
047B 1801    01720          JR      MOVCRY
047D 37      01730 ISSET    SCF               ;set carry flag as bit i
047E CB13    01740 MOVCRY   RL      E         ;mve data from carry - '
0480 23      01750          INC     HL        ;move to next data locat
0481 10F2    01760          DJNZ    LOPBIT
             01900 ;  data for print is stored in 'E'
0483 7B      01910          LD      A,E       ;load 'A' with 'E'
0484 CD4580  01920          CALL    8045H     ;basic rom printer routi
0487 3E00    01930          LD      A,0       ;reset character rom so
0489 D30B    01940          OUT     (0BH),A   ;  program can read scre
             02000 ;  routine to check that all data for current char
             02010 ;  been generated . If so move onto next.
048B 3A1700  02020 DONE8    LD      A,(DOT)   ;ld 'A' with curr column
048E 3D      02030          DEC     A         ;move to next dot/column
048F 321700  02035          LD      (DOT),A
0492 FEFF    02040          CP      0FFH      ;test for finish
0494 20C9    02050          JR      NZ,FINDPD ;If not finished - FINDF
0496 3E07    02060          LD      A,7       ;column fin.  Reset colu
0498 321700  02070          LD      (DOT),A   ;     to   seven
             02100 ;
             02110 ; do next char in line
             02120 ;
049B 3A1600  02130 NXTCHR   LD      A,(CHARCT);ld 'A' with char counte
049E 3D      02140          DEC     A
049F 321600  02150          LD      (CHARCT),A
04A2 FE00    02152          CP      0         ;test for 1 line done
04A4 F5      02155          PUSH    AF        ;save result on stack
04A5 211500  02160          LD      HL,TOPBOT
04A8 CB46    02170          BIT     0,(HL)    ;test for top/bot. line
04AA 2012    02180          JR      NZ,BOTELN
04AC 2A1000  02190          LD      HL,(CURR1) ;ld 'HL' with curr top
04AF 23      02200          INC     HL
04B0 221000  02210          LD      (CURR1),HL
04B3 F1      02230          POP     AF         ;pop result of prev. te
04B4 2086    02240          JR      NZ,FINDCH  ;if not at end of line
04B6 3E01    02250          LD      A,1        ;if at end of line set
04B8 321500  02260          LD      (TOPBOT),A ;  current line to bott
04BB C32104  02270          JP      LINSTR     ; continue on bottom li
04BE 2A1200  02280 BOTELN   LD      HL,(CURR2) ;ld 'HL' with bottom li
04C1 23      02290          INC     HL         ;next char
04C2 221200  02300          LD      (CURR2),HL
04C5 F1      02310          POP     AF         ;pop  result of test
04C6 C23C04  02330          JP      NZ,FINDCH  ;if not fin. goto FINDC
04C9 3E00    02340          LD      A,0        ;fin.  reset top/bot  t
04CB 321500  02350          LD      (TOPBOT),A ;top
04CE 3A1400  02360 ENDLN    LD      A,(LINE)   ; load 'A' with no. of
04D1 3D      02370          DEC     A          ;screen lines left and
04D2 321400  02380          LD      (LINE),A   ;dec by one
04D5 C22104  02390          JP      NZ,LINSTR  ;test for no more left
04D8 C9      02420          RET                  ;return to program
             04900 ;
             05000 ; test for bit 'A' at location 'hl'
             05010 ;
04D9 4E      05020 TSTBIT   LD      C,(HL)     ;load data into b to te
04DA 3A1700  05040          LD      A,(DOT)    ;bit to test in char .
04DD FE00    05050          CP      0
04DF 282D    05060          JR      Z,BIT0
04E1 FE01    05070          CP      1
04E3 2826    05080          JR      Z,BIT1
04E5 FE02    05090          CP      2
04E7 281F    05100          JR      Z,BIT2
04E9 FE03    05110          CP      3
04EB 2818    05120          JR      Z,BIT3
04ED FE04    05130          CP      4
04EF 2811    05140          JR      Z,BIT4
04F1 FE05    05150          CP      5
04F3 280A    05160          JR      Z,BIT5
04F5 FE06    05170          CP      6
04F7 2803    05180          JR      Z,BIT6
04F9 CB79    05190 BIT7     BIT     7,C
04FB C9      05200          RET
04FC CB71    05210 BIT6     BIT     6,C
04FE C9      05220          RET
04FF CB69    05230 BIT5     BIT     5,C
0501 C9      05240          RET
0502 CB61    05250 BIT4     BIT     4,C
0504 C9      05260          RET
```

```
DDR   CODE    LINE  LABEL  MNEM    OPERAND

0505 CB59     05270 BIT3   BIT   3,C
0507 C9       05280        RET
0508 CB51     05290 BIT2   BIT   2,C
050A C9       05300        RET
050B CB49     05310 BIT1   BIT   1,C
050D C9       05320        RET
050E CB41     05330 BIT0   BIT   0,C
0510 C9       05340        RET
              05350 ;DATA FOR PRINTER INITIALIZATION
              05360 ;
511 1B33      05370 LF     DEFW    331BH    ; ESC.  3
513 1000      05380        DEFW    0010H    ; 16    0
515 1B        05385 SGD    DEFB    1BH      ; ESC.
516 4B        05390        DEFB    'K'      ; K    single denisty
517 E0        05400        DEFB    224D
518 01        05410        DEFB    1H
519 00        05415        DEFB    0
51A 1B        05416 DD     DEFB    1BH      ; ESC.
51B 4C        05420        DEFB    'L'      ; L    double denisty
51C E1        05430        DEFB    225D
51D 01        05440        DEFB    1
51E 00        05445        DEFB    0
              05455 ;
```

```
CODE   LINE   LABEL  MNEM     OPERAND

              05465 ;   OUT TO PRINTER ROUTINE
              05475 ;
051F 7E       05485 PRINTR  LD      A,(HL)
0520 23       05495         INC     HL
0521 FE00     05505         CP      0
0523 C8       05515         RET     Z
0524 CD4580   05525         CALL    8045H
0527 18F6     05535         JR      PRINTR
0000          05545         END
00000 Total errors

BIT7    04F9    BIT6    04FC    BIT5    04FF    BIT4    0502
BIT3    0505    BIT2    0508    BIT1    050B    BIT0    050E
ENDLN   04CE    BOTELN  04BE    NXTCHR  049B    DONE8   048B
MOVCRY  047E    ISSET   047D    TSTBIT  04D9    LOPBIT  0475
LOPE    0473    PNDT    046F    FINDPD  045F    ROTATE  0452
FINDDT  044C    LDA     044B    TPLNCH  0448    FINDCH  043C
SGD     0515    CONTI   0439    DD      051A    SINGLE  0436
LINSTR  0421    PRINTR  051F    LF      0511    INITLF  041B
INITAL  0408    DOUDEN  0404    START   0405    SINDEN  0400
MODE    001A    DATA    0018    DOT     0017    CHAR    0040
CHARCT  0016    TOPBOT  0015    LINE    0014    CURR2   0012
CURR1   0010
```

IGH RESOLUTION GRAPHIC

Daniel Wong, Parramatta NSW

his program enables the user to draw high resoluon graphics on the screen. To draw use these keys
 move the cursor: W up; A left; S right; Z down.

IGH RESOLUTION GRAPHIC

```
00180 X=100:Y=150
00190 CLS:HIRES
00200 HIRES
00210 CURS 65
00220 CURS 10,4
00230 FOR I=10 TO 54:PRINT ".";:NEXT I
00240 FOR J=5 TO 13
00250  CURS 10,J:PRINT ".":CURS 54,J:PRINT "."
00260 NEXT J
00270 CURS 10,14
00280 FOR I=10 TO 54:PRINT ".";:NEXT I
00290 CURS 0:PRINT "PCG CHARCATERS USED ="
```

```
00300 PRINT"DRAW ONLY WITHIN THE SQUARE"
00310 ON ERROR GOTO 420
00320 CURS 21:PRINT USED;
00330  SET X,Y
00340  K1$=KEY$
00350  IF K1$="" THEN RESET X,Y:GOTO 330
00360  IF K1$>"Z" THEN RESET X,Y:A=ASC(K1$):
       K1$=CHR$(A-32)
00370  IF K1$="W" THEN LET Y=Y+1:GOTO 320
00380  IF K1$="S" THEN LET X=X+1:GOTO 320
00390  IF K1$="Z" THEN LET Y=Y-1:GOTO 320
00400  IF K1$="A" THEN LET X=X-1:GOTO 320
00410 GOTO 330
00420 REM *** ERROR HANDLING ***
00430  PLAY 1,1
00440  ON ERROR GOTO 420
00450  GOTO 340
```

UTTING CONTROL HARACTERS IN A ORDBEE FILE

ichael Dunbar, Murrumbeena Vic.

ordbee, for the Microbee, is a very good word proessor. However, a disadvantage is that when using Epsom-type printer you cannot send control aracters in the middle of a paragraph to alter the rintout e.g: to underline or place some words in alics. These control characters usually consist of e ESC character followed by a normal printing aracter.

This shortcoming was partially overcome with e introduction of Wordbee 1.2, enabling double riking and underlining in the middle of a paragraph. his is achieved by the software; send the character, llowed by a backspace, then either the character gain, for double strike, or an underline if you want underline. Control characters are not sent to place e printer in either mode.

However, it is still desirable to be able to print ords in italics e.g: botanical names. To do this you ave to place the control characters in the middle of paragraph. A '.ES' for the middle of a paragraph is t supported by either version of Wordbee. The dot mmand '.ES' is used to send control characters to e printer between paragraphs.

There are two ways of inserting the control characrs into the file.

ethod 1.

r short files or where the characters are to be inserted near the top of the file.

1. In the locations where control characters are to be inserted place a finger (1), one for each non-printing control character to be inserted.

2. Return to the Menu (LINE FEED).

3. Go to Moniter Level (M).

4. Type E 900.

5. Using the monitor cursor movement controls (A W S Z) locate the fingers, hex 7C.

6. Press M to enter (Modify Mode). Then replace the 7Cs with the desired code in hex; see your printer handbook to obtain the correct codes.

7. Go to step 5 until all the desired changes have been made.

8. Press ESC followed by an X, then RETURN. This returns you to the Wordbee file.

Method 2.

For long files where manually searching for the finger characters can be time consuming.

1. In the locations where control characters are to be inserted place a finger (I), one for each non-printing control character to be inserted.

2. Return to the Menu (LINE FEED).

3. Go to Moniter Level (M).

4. Type E 51D. This gives the location of the end of the file.

5. Press ESC, then type S 900 XXYY 7C, where XX is the number at 51E (on the right of the arrow cursor), and YY is the number at 51D (on the left of the arrow cursor).

6. The location of the fingers is now displayed below the memory display.

7. Type A ZZZZ, where ZZZZ is the location of the finger, from the table given in step 6.

8. Replace the fingers with the required control characters; see your printer handbook to obtain the correct codes. When finished press the ESC key to exit so that another set of fingers can be replaced.

9. Go to step 5 until all the desired changes have been made.

10. Press ESC followed by X then RETURN; this returns you to the Wordbee file.

Notes

Once inserted the control characters can be moved using the Block Functions Command (B).

If a file with control characters in it has to be force loaded, the control characters will be replaced by the finger character and will have to be changed back to their original control characters.

The finger was selected as the most suitable character since the Wordbee Force Loader replaces any control characters with the finger character, but this does not stop you using another character.

When looking at a file with control characters in it, they will be shown as graphics characters.

The control characters, 00 hex to 0B hex, cannot be inserted into the file since they cause the printing to stop at the point where these characters occur.

Control characters in the range 80 hex to FF hex have 80 hex subtracted from them by Wordbee when you view the file.

S short machine code program could be written to change the finger characters to ESC characters, loaded and run from the Monitor.

This method can also be used to print some of the printer's graphics characters.

✶ENCOURAGEMENT✶

Ozi-Soft, in conjunction with Computer Technics, is offering to donate a VIC-20 expansion board for the best software item submitted to this column every month.

The board is Australian-designed and manufactured and simply plugs into the VIC-20's expansion slot. It features three sockets that can be independently switch-selected, plus an on-board reset switch. With it you can plug in up to three separate expansion units to your VIC-20 and avoid the hassle of plugging things in and out and turning the computer on and off each time.

It is distributed by **Computer Technics, 123 Clarence Street, Sydney (G.P.O. Box 4936) NSW 2000. (02)29-7244.** The board costs $59.95.

All submissions must be accompanied by a signed letter from you stating that it's your original work. The winning submission will be judged by the Editor and no correspondence will be entered into. All published submissions will be paid for.

Send entries to: **The Editor, VIC-20 Column, ETI Magazine, P.O. Box 227, Waterloo NSW 2017.**

LAND THE PLANE

A simple game in which the object is to land the plane without crashing into the towers.

To assist the landing, bombs are provided. These may be released by pressing any key.

The level at which the plane came to grief will be noted for you. The idea is to see how low a level may be achieved before this happens. Note that only two bombs per run will be provided.

Thanks to S. Austin for the idea (ETI, April 1983, p.109)

```
10 PRINT "clear,home": V1=36878: T3=36877
20 FOR X = 3 TO 20
30 FOR Y = 22 TO 3 + RND(1)*20 STEP -1
40 GOSUB 500: POKE P9,160+72*INT(RND(1)+.1)
50 NEXT Y:NEXT X
60 PRINT "LEVEL:";TAB(14);"BOMBS:"
70 FOR Y = 2 TO 22:B=2
80 GOSUB 600
90 FOR X = 0 TO 22
100 GOSUB 700
110 GOSUB 500:P=PEEK(P9):POKE P9,
    114:POKE P9-1,96
120 IF P > 100 THEN X=100:Y=100:GOTO 250
130 POKE P9,114: POKE P9-1,96
140 GET A$: IF LEN(A$)=0 OR B=0 THEN 240
150 POKE V1,15: POKE T3,0: Y3=Y
160 FOR Y1=Y+2TO 22
170 POKE 36876,(256-6*Y1): Y=Y1
180 GOSUB 500 : POKE P9,81
190 POKE P9-22,32
200 NEXT Y1
210 Y=Y3: POKE 198,0
220 GOSUB 800
230 B=B-1
240 GOSUB 500:POKE P9,96
250 NEXT X: NEXT Y
260 IF X > 99 THEN 280
270 PRINT"clear,home":PRINT:PRINT"VERY GOOD"
280 FOR V2=1 TO 15 STEP V2/15
290 POKE V1,V2: POKE T3,220-8*V2
300 NEXT V2
310 PRINT"clear,home":PRINT:PRINT"LEVEL";Z
320 PRINT:PRINT"PRESS RETURN OR"
330 PRINT "PRESS E FOR EXIT":INPUT A$
340 IF A$="E" THEN END
350 GOTO 10
500 P9=7680+22*Y+X
510 POKE P9+30720,0
520 RETURN
600 Z=22-Y:Q=INT((Z+.5)/10):Q1=Z-Q*10
610 POKE 7709,Q1+48:POKE 38429,0
620 POKE 7708,Q+48:POKE 38428,0
630 RETURN
700 POKE 7722,B+48: POKE 38442,0
710 RETURN
800 FOR T= 1 TO 33
810 POKE V1,15*RND(1)
820 POKE T3,128+RND(1)*128
830 NEXT T
840 POKE V1,0
850 RETURN
```

Neil Duncan, Heathmont, Vic.

Peter Skilton and Gary Fowler, of Seaford Victoria, the authors of the program 'Calendar', are this month's winners of the VIC-20 expansion board.

CALENDAR

A calendar is displayed for any month or year in the Gregorian calendar.

Leap-yearing, or intercalation, has been practised every four years since Roman times. However, in 1582 Pope Gregory III proposed that of all the years which are a multiple of 100, not all should be leap years. Only those which are a multiple of 400 should be intercalated ie: the year 2000 is a leap year, but 1900, 1800 and 1700 were not. In addition, multiples of 4000 should not be leap years.

This program easily fits into the standard 3.6K of available memory and executes quite rapidly on the VIC.

The algorithm calculates the calendar for any month of any year and displays it centred on a white VDU screen. REM statements have been included for clarity so that variables and the operations used may be simply followed.

Notice that lines 290 and 540 have been used to overcome round-off error in the INT function, e.g.: INT (14.9999) = 14 or INT (−1.00002) = −2. The CHR$ statements, as in line 300, merely clearly/home the screen and are shown for typographical convenience

Once the selected calendar is shown on the VDU the program waits without prompting. Typing in the letter 'M' enables you to change the month only, typing in a 'Y' allows you to alter the year and month for the next calendar, while responding with a carriage return escapes from the program.

```
READY.                            DECEMBER
RUN
                          SU MO TU WE TH FR S

 DESIRED YEAR ? 1999                1  2  3
 MONTH NUMBER ? 12
                           5  6  7  8  9 10 1

                          12 13 14 15 16 17 1

        1 9 9 9           19 20 21 22 23 24 2

                          26 27 28 29 30 31
```

```
190 REM
200 REM   Initialize
210 POKE 36879,25
220 DIM B$(22),D$(24),M$(120),Y$(4)
230 DATA "  JANUARY  FEBRUARY    M","ARCH     APRIL     MAY "
240 DATA "     JUNE      JULY     ","AUGUST   SEPTEMBER  OCTO"
250 DATA "BER  NOVEMBER  DECEMBER ","312831303130313130313031"
260 FOR I = 1 TO 5  :  READ D$  :  M$ = M$ + D$  :  NEXT I
270 READ D$
280 REM   Prevent round-off errors
290 DEF FNI(J) = INT(1.00002*J)
300 PRINT CHR$(147);CHR$(19)
310 PRINT "  DESIRED YEAR ";  :  INPUT Y
320 PRINT "  MONTH NUMBER ";  :  INPUT N
330 REM   N = 1,2,.......,12 for Jan,Feb,.......,Dec
340 PRINT  :  PRINT  :  PRINT  :  PRINT  :  PRINT "       ";
350 Y$ = STR$(Y)
360 FOR I = 1 TO LEN(Y$)  :  PRINT MID$(Y$,I,1);" ";  :  NEXT I
370 PRINT  :  PRINT  :  PRINT
380 PRINT "      ";MID$(M$,10*N-9,10)  :  PRINT
390 PRINT " SU MO TU WE TH FR SA"  :  PRINT
400 REM   Y1 = year of the century C  :  T = no. of days in month N
410 C = FNI(Y/100)  :  Y1 = Y - 100*C
420 T = VAL(MID$(D$,2*N-1,2))  :  IF N<>2 THEN GOTO 470
430 REM   Check for leap years
440 IF Y = 4*FNI(Y/4) THEN LET T = 29
450 IF Y = 100*C AND Y>400*FNI(Y/400) THEN LET T = 28
460 IF Y = 4000*FNI(Y/4000) THEN LET T = 28
470 REM   Jan and Feb are considered the 13th and 14th
480 REM   months of the Previous year
490 IF N<3 THEN LET Y1 = Y1 - 1  :  N = N + 12
500 IF Y1 = -1 THEN LET Y1 = 99  :  C = C - 1
510 REM   F = first day of the month (1,2,...7 for Sun,Mon,...Sat)
520 F = FNI(2.6*(N+1)) + Y1 + FNI(Y1/4)
530 F = F + FNI(C/4) - 2*C - FNI(C/40) + 1
540 IF F<1 THEN LET F = F + 7  :  GOTO 540
550 F = F - 7*FNI((F-1)/7)
560 REM   Print out the calendar one line at a time
570 D = 1
580 FOR I = 1 TO 6
590   B$ = ""
600   FOR J = 1 TO 7
610     IF F>(I-1)*7+J THEN LET B$ = B$ + "   "  :  GOTO 650
620     IF D<10 THEN LET B$ = B$ + " "
630     B$ = B$ + STR$(D)  :  D = D + 1
640     IF D>T THEN PRINT B$  :  PRINT  :  PRINT  :  PRINT  :  GOTO 680
650   NEXT J
660   PRINT B$  :  PRINT
670 NEXT I
680 IF I<6 THEN PRINT  :  IF I=4 THEN PRINT
690 REM   Program Pauses - to change the month, type 'M', to change
700 REM   the year and month, type 'Y', and to abort type return
710 GET Y$
720 IF Y$ = "Y" THEN GOTO 300
730 IF Y$ = "M" THEN PRINT CHR$(147);CHR$(19)  :  PRINT  :  GOTO 320
740 IF Y$<>CHR$(13) THEN GOTO 710
750 PRINT CHR$(147);CHR$(19)  :  PRINT "FINISHED"
760 END
```

Peter Skilton and Gary Fowler, Seaford, Vic

MEGAMEANIES

The objective of this game is to 'kill or be killed', which happens in the end anyway!

There are two Megameanies slowly sweeping over your planet in sine and cosine curves, getting lower each time. They change colour according to their point rating, e.g.: white ones are worth seven and yellow ones are worth one.

You have a single gun and unlimited ammunition to blast the Megameanies out of the sky before they invade you. You can only fire one missile at a time but it moves two spaces for every one of the Megameanies.

For every five Megameanies shot down you obtain five times the normal score for the Meanie. When your score reaches 80 you get an extra game and 20 extra points.

The game uses programmable characters residing from 7168 to 7679 using character set 255.

It also contains many interesting tricks such as POKE 198,0:WAIT198,1 which waits until a key is pressed by first clearing the keyboard buffer and then WAITing for a character to be entered via the keyboard. The alternative method for this is GETA$:IFA$=" "THEN. . . .

Chris Groenhout, Watson ACT

```
5 REM **** (C) CHRIS GROENHOUT 1983 ****
10 POKE36879,8:FY=22:PX=11:GOSUB430:PRINT"♥"CHR$(8):POKE36869,255
20 FORM=1TO21STEP3:E=E+1:FORD=0TO2:FORN=0TO21:POKE38400+N+((M+D)*22),E:NEXTN,D,M
30 IFFF=1THENFF=2
40 FORYY=5TO18
50 FORX=0TO2*πSTEP.28:PRINT"SESCORE@"SC
60 Y=INT(SIN(X)*4+YY):Y2=INT(COS(X)*4+YY):IFY=22THENGOTO190
70 XX=X*3.5:POKE7680+XX+Y*22,63:POKE7680+X1+Y1*22,32
80 POKE7680+XX+Y2*22,63:POKE7680+X1+Y3*22,32
90 X1=XX:Y1=Y:Y3=Y2:IFPEEK(197)=31THENPX=PX-1:IFPX<0THENPX=0
100 IFPEEK(197)=23THENPX=PX+1:IFPX>21THENPX=21
110 POKE8164+PX,62:POKEPX+38884+PX,1:POKE(PX-1)+8164,32:POKEPX+1+8164,32
120 IFPEEK(197)=32ANDC=0THENC=1:CX=PX
130 FORH=1TO2
140 IFC=1THENFY=FY-1:IFFY<0THENC=0:FY=22:POKE7680+CX,32
150 F=7680+CX+FY*22:IFPEEK(F)=63THENGOTO240
160 IFC=1THENPOKEF,28:POKEF+22,32:POKE36877,FY*2+128
170 NEXT
180 NEXTX,YY
190 PRINT"SE YOU'VE BEEN OVERRUN!"
200 FORA=1TO3000:NEXT
210 PRINT"SAGAIN[                    ":POKE198,0
220 WAIT198,1:IFPEEK(631)=89THENPRINT"♥":CLR:FY=22:PX=11:GOTO20
230 POKE198,0:POKE36879,27:POKE36869,240:PRINT"♥="":END
240 BD=BD+1:SC=SC+ABS((PEEK(F+30720)AND15)-8):PRINT"SESCORE@"SC
250 POKEF,58:POKEF+1,59:POKEF+22,60:POKEF+23,61
260 IFBD/5=INT(BD/5)THENSC=SC+4*ABS((PEEK(F+30720)AND15)-8)
270 IFSC>79ANDFF=0THENSC=SC+20:E=0:FF=1
280 POKE36877,200
290 FORA=15TO0STEP-.04:POKE36878,A:NEXT:POKE36877,0
300 POKEF,32:POKEF+1,32:POKEF+22,32:POKEF+23,32:FY=22:C=0:IFFF=2ORFF=0GOTO160
310 IFFF=1THENGOSUB400:GOTO20
320 POKE52,28:POKE56,28:FORA=0TO464:POKE7168+A,PEEK(32768+A):NEXT
330 FORA=0TO7:POKE7168+A,PEEK(33256+A):NEXT
340 FORA=0TO7:POKE7384+A,PEEK(33272+A):NEXT
350 FORA=1TO48:READDD:POKE7631+A,DD:NEXT
360 FORA=0TO7:READDD:POKE7392+A,DD:NEXT:RETURN
370 DATA1,30,32,67,68,73,138,138,240,12,4,228,18,146,82,82,138,82,89,72,71,32,62
,1,81
380 DATA82,146,36,196,12,48,192,16,16,16,16,56,124,254,198,129,66,165,24,126,219
,189
390 DATA129,16,56,56,56,56,56,56,84,84
400 PRINT"♥E      BONUS GAME!":POKE36878,15:POKE36876,222
410 FORA=1TO1000:NEXT
420 PRINT"♥":POKE36876,0:POKE36878,0:RETURN
430 PRINT"♥T"CHR$(8);
440 PRINTTAB(4)"*************"
450 PRINTTAB(4)"*MEGAMEANIES*"
460 PRINTTAB(4)"*************"
470 PRINT"QE THE MEGAMEANIES ARE"
480 PRINT"   TAKING OVER THE"
490 PRINT"  UNIVERSE AND IT IS"
500 PRINT"YOUR JOB TO STOP THEM"
510 PRINT"  TAKING OVER YOUR"
520 PRINT"        PLANET."
530 PRINT"Q◣KEYS TO USE:"
540 PRINT"QECURSOR KEYS,MOVEMENT."
550 PRINT"QE↑ = LEFT"
560 PRINT"← = RIGHT"
570 PRINT"QSPACE BAR = FIRE"
580 GOSUB320
590 PRINT"QQ▮PRESS ANY KEY TO PLAY":POKE198,0:WAIT198,1:RETURN
600 GOSUB320

READY.
```

DRAWING BOARD

This program is used on an unexpanded VIC-20. You can space, erase, terminate and clear the screen.

The graphics block (character 102) is put in the middle of the screen to start off.

Full instructions are included in the program.

```
1    Print "(clr screen) *********************"
2    Print "* Drawing Board *"
3    Print "*********************"
4    Print "(cursor down) (space) THE Controls:"
5    Print "U = Up; L = Left; R = Right; D =
     Down"
6    Print "(cursor down) E to put into Erase
     Mode"
7    Print "(cursor down) S to put into Space
     Mode"
9    Print "(cursor down) C to Clear Screen"
10   Print "(cursor down) T to Terminate Program"
11   Print "(cursor down) And W to put into draw
     mode again
16   For T = 1 to 9000: Next
19   Print "(Clear Screen)"
20   Poke 368 79, 8
30   A = 7910
40   Poke A, 102
50   Get A$
60   If A$ = "U" then A = A − 22
70   If A$ = "D" then A = A + 22
80   If A$ = "L" then A = A − 1
81   If A$ = "R" then A = A + 1
82   If A$ = "C" then Print "(Clear Screen)": Go to
     19
83   If A$ = "E" then go ıo 1000
84   If A$ = "S" then go to 5000
85   If A$ = "T" then W End
86   Go to 40
1000 Poke A, 32
1010 Get C$
1020 If C$ = "U" then A = A − 22
1030 If C$ = "D" then A = A + 22
1040 If C$ = "R" then A = A + 1
1050 If C$ = "L" then A = A − 1
1055 If C$ = "W" then go to 50
1056 If C$ = "C" then Print "(Clear Screen)": go to
     19
1057 Go to 1000
5000 Poke A, 102
5001 Get B$
5002 If B$ = "U" then Poke A, 32: A = A − 22
5003 If B$ = "D" then Poke A, 32: A = A + 22
5004 If B$ = "L" then Poke A, 32: A = A − 1
5005 If B$ = "R" then Poke A, 32: A = A + 1
5006 If B$ = "C" then Print "(Clear Screen)": go to
     19
5007 If B$ = "W" then go to 40
5008 Go to 5000
```

Damien Page, Stafford Qld

EXPERIMENTERS MODIFICATIONS TO THE '660 TO OBTAIN A 64 x 64 PIXEL DISPLAY

COLOUR TEST PROGRAM

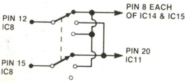
Here are some simple and inexpensive modifications you can make to your '660 to obtain a screen display of 64 pixels across and 64 pixels down, in fact, you can even sample the new mode before making all the hardware modifications at the cost of a switch and a few resistors, like I did to bring you this!

To sum up this project, I will describe how you can make hardware changes to your '660, give you modifications to be made to the monitor program, sample programs to play with and even a machine code sub-routine that will change all your present programs to run on this new mode for an all-up price of no more than $30. In fact, firstly I will tell you how you can sample the end result almost as soon as you finish reading this article!

Modifications to be made are quite simple and involve constructing a "double decker IC socket" (DDIC) to replace your present 2716, cutting a few tracks and having a "mode select" switch to select either the present monitor or the modified monitor contained in another 2716, or even your own monitor program in random access memory. A new IC will have to be installed, this is IC23, a 74LS245, located on-board between the 1802 and the 1864; details later as now I'll show you the new display.

Remove link 1, put a 47k resister between pin 20 of IC11 and + 5 V. You can use the holes provided for R29 but cut the 0 V track and extend the resistor's wire to the nearby supply rail. Cut the track from pin 12 of IC8 to the pins 8 of ICs 14 & 15, place a 47k resistor from here to the supply rail.

Attach suitable lengths of hook up wire to: the feedthrough for pin 12 of IC8, the feedthrough for pin 8 of IC15 and each end of the removed link 1. Remember, these wires will be used in the final modifications and these modifications are also part of the final design. Wire up the switch as shown here.



With the switch in the 'normal' mode, and the '660 back in one piece, you can switch on the power. If the screen comes up, then all should be well. Refer to the "Monitor Duplicator" program, do that, make the alterations to the monitor program (starting at OCOO) as shown in "Modified Monitor" then, whilst pressing the reset, switch over to the RAM mode and up should come your 64 x 64 display.

What you have now is a monitor in RAM. Remember it is volatile. You can now run the sample programs and, if you like it, you can go on to completing the rest of the project. ●

Figure 1.

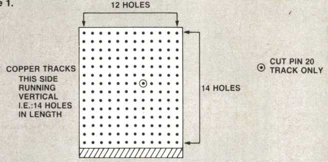


Figure 2.

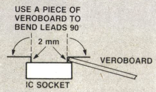
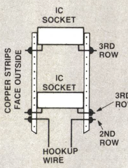
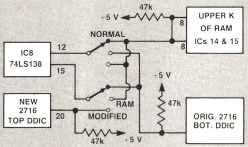


Figure 3.





BLOCK DIAGRAM
— completed modifications

GOING ALL THE WAY

Firstly, that 74LS245; refer to page 40 Nov '81, IC23. Turn back to page 26 and take a look at the pin holes for this IC, in particular the fact that the following pins are actually joined together: 2&18, 3&17, 4&16, 5&15, 6&14, 7&13, 8&12 and 9&11 (phew!). As this IC is a data buss buffer you will have to cut these tracks before installing IC23 so as to make pins 2-to-9 the inputs and pins 18-to-11 the outputs or vice-versa.

In order for this new display to be of real benefit, the modified monitor will have to be put into another 2716 (or 2708) and installed on-board. Assuming you have made the previous modifications, the rest is a piece of byte, I mean cake.

You'll need a piece of Veroboard with 2.45 mm hole centres and copper strips running on each row of holes. Cut two pieces to the size as shown Figure 1. File off the bottom end of each row to prevent shorts when the DDIC is in place. Bend over the leads of each of the 24 pin wirewrap sockets as shown Figure 2.

Now refer to Figure 3 and solder in the upper and lower sockets, ensuring the pin 1 of each socket is facing the same way, these are mounted into the 3rd row of holes from the top and bottom. Then do the other side. Note that the copper tracks are facing the outsides. Identify pin 20 and cut this track in the centre, insert a 47k to the top socket from pin 20 to pin 24, then, using solid hookup wire, solder a piece to each of the 24 bottom 2nd-row holes. The wire must not be too thick and it must extend below the bottom of the board by 5 mm on the inside as per Figure 3. These form the IC socket pins.

Checking that the DDIC is wired correctly, and that there are no solder bridges, you can now carefully remove the original 2716 IC socket and replace with your new DDIC. Make sure the pin 1s are the right way around.

Solder a piece of hookup wire to pin 20 of the top 2716 socket. This goes to the mode switch which you can now finish wiring as shown in the block diagram.

Put your original 2716 in the lower socket and your new 2716 in the top. Check over all your work and wiring before putting your '660 together, check whole board for any foreign objects (solder, bits of wire). ▶

With the mode switch in the modified position switch on the juice and if all is well you should be greeted with the new display. If not, switch off and check from the very start to correct the fault. You must ensure the 47k resistors are in place as these isolate the RAM or ROM when not in use.

Assuming both modes now work you can go on to fully test the new display. ●

WHAT'S CHANGED

A few but important facts must be kept in mind. In the original mode, nothing has changed (as one would expect), but in the modified mode the following are the rules, and in the other mode (RAM) you can make up your own rules.

Chip 8 programs now start running at 0700.
RAM available to programmer, 0700-OFFF and 0480-04EF.
Screen display now starts at 04F0 instead of 0480.
There is no address bar at the bottom of the screen but only the address and data are shown, and they're spaced further apart. ●

PAINTING BY NUMBERS OVER 17 HEX

With the mode switch in the modified mode, load the "colour routines" machine code subroutine at 049F and the colour test program at 0700. You can then test out the new screen. In fact, this program is similar to the one shown in April '82 (did they steal my idea?) but here you can colour the whole screen, and because of this you have to specify a two-digit down co-ordinate.

The top LHC is 0-00-3. This will make it violet (not grey); the bottom RHC green — 7-1F-4. Now what's the BLHC, or the TRHC, or even the KGB???

Unlike the MCSR shown in the April '82 issue, this routine will NOT leave the colour code in RAM starting at OCFO (OC80). However, as this is required for some programs (like PATCHES) this can be achieved by changing the end of the MCSR from 04E6 as shown. ●

```
0700    61F0 6200 60FF A4F0 F055 7101 3100 1708
0710    7201 3203 1708 04A2 F10A F20A 8224 8224
0720    8224 8224 F00A 8204 F00A 04B2 049F 1718.
```

MODIFIED MONITOR

Here is a list of the changes required to be made to the original monitor program as is shown in ETI Nov 81. This will enable the display of 64 x 64 and Chip 8 programs start running at 0700.

```
 ADDRESS      CODE
01D/C1D        56
025/C25        56
02F/C2F        66
033/C33        49
037/C37        5A
03E/C3E       004D
046/C46        27
04A/C4A       7210
        C     36F8
        E     E2A1
       50     F8D4
        2     D1C0
        4     0166
        6     02EB
        8     00F8
        A     02F2
        C     6809
        E     693B
       60     00BF
        2     2066
        4     00BD
        6     F129
        8     206C
        A     F029
        C     D895
        E     7805
       70     00EE
0E3/CE3        F0
0EA/CEA        07
13F/D3F        F0
14E/D4E       80E2
       50     E220
        2     A0E2
        4     20A0
        6     3C45
        8     9832
        A     5FA0
        C     2080
        E     B888
       60     3235
        2     7B28
        4     3036
275/E75        F0
282/E82        07
2D8/ED8        07
2F3/EF3        06
2F6/EF6        B8
2F9/EF9        00
3B5/FB5        9F
```

Note that 01D refers to location 001D and C1D to 0C1D (RAM equivilent).

MONITOR DUPLICATOR

This machine code routine will duplicate the monitor program from 0000 — 03FF and place it at OCOO — OFFF. Changes can then be made to it and the mode switch placed to the RAM position (whilst you keep the reset key pressed) and zap!, up comes you new display of 64 x 64 pixels.

Load the program at OBEO, bring up this address on the screen then press RESET followed by key six (6). When the screen comes back on, all is done.

```
0BE0     F800 B0A0 AEBF AFF8
0BE8     0CBE 4F5E 1E9E FF10
0BF0     3AEA D0.
```

OLD TO NEW '660

This machine code routine will change all OXMM, 1XMM, 2XMM, AXMM, and BXMM Chip 8 instructions to one page higher, provided X is equal to or greater than six (6).

With your '660 in the modified mode, load this program at 0480 then load your original '660 program (from 0600) into memory from 0700 onward to + 1 page of the end of the program. Any present '660 program that extends beyond OEFF is not suitable.

Programs will still have to be inspected to identify and adjust MCSRs or display data. Consideration will also have to be given to the start of screen memory at O4FO. Run this, as above, with 0480 displayed.

```
0480     F8F7 BEF8 00AE 0EFA
0488     F0AF 32A5 FF10 32A5
0490     8FFF 2032 A58F FFA0
0498     32A5 8FFF B032 A51E
04A0     1E9E 3A86 DE0E FA0F
04A8     FF06 3B9F 0EFC 015E
04B0     309F.
```

COLOUR ROUTINES

Refer to ETI April 1982. VO is now the colour code (VD), V1 is now the across (VE), V2 is now the down (VF). To enable colour — 04A2 (07C1), to alter background — now 049F (0742), and to alter colour — "2 Byte area" now 04B2 (27AB).

```
049F     E9
04A0     61D4 F839 AF96 BFEF
04A8     F82C 5F62 2FF8 205F
04B0     62D4 96BF BEF6 AEEE
04B8     F872 AF0F 732F 0F73
04C0     2F0F 5E72 FA07 BFF0
04C8     FA07 5E1E F0FA 1FFE
04D0     FEFE FE5E F80C 7C00
04D8     BDF8 F0F4 AF9D 7C00
04E0     BD8F 2EF4 ADED F0AF
04E8     9F5D 632D 8F5D E2D4.
```

To record colour code after above from:

```
O4E6        9F5D   63E2   D4.
```

WHAT NOW?

Now it's time for you to put on your thinking cap to change suitable games over to this new display. To demonstrate the "Old to New" '660 program, load in "Target Practice" as per Nov '81, then run the MCSR and press RUN.

This game works OK, but not all games will be so, especially any of my games published to date and it's these type of programs that require inspection. A knowledge of machine code would be helpful in this regard and in some cases necessary. The book by Tom Swann (see p 96, March '82) I can highly recommend. Another book on the subject is available from RCA, called "User Manual for the CDP1802 COSMAC Microprocessor". MPM-201c, but his book is not quite so easy to understand for a beginner.

Bill Kreykes, St Albans, Vic.

TAKE ADVANTAGE OF DICK'S DESPERATION!

AT THESE PRICES YOU CAN'T AFFORD TO MISS OUT!

HERE IT IS-
THE
BICYCLE COMPUTER!

Add a bike computer to your pushbike and you'll really know how well you're doing. Very simple to fit on all types of pushbikes, displays distance, speed, elapsed time, average speed, etc. Cat Y-3010

ONLY **$49⁵⁰**

3 digit counter module kit

The most versatile unit around. Display can be removed for external mounting. 5 – 15V., Cat K-3451

$17⁹⁵ GREAT VALUE

150W Mosfet Amplifier Kit

Yes! 150W watts of sheer audio muscle – fantastic for PA, guitar amps, etc, etc. And now get the power tranny thrown in as well! Hurry limited stock. Cat K-3525

ONLY **$119⁰⁰**

NOW INCLUDES FREE M0153 transformer (normally $52 extra)

POWERFUL ALL MODE

FANTASTIC

YAESU FT 757 GX AMATEUR TRANSCEIVER

Everything you could ever want. . . and then some! Even before its release, Yaesu had over 5000 on back order. Computer Aided Design and Computer Aided Manufacture ensures unbelievable standard of reliability. Cat D-2940

NOT ~~$1399~~
NOT ~~$1199~~
DICK'S PRICE ONLY **$999⁰⁰**

SAVE $$$

SAVE $100!

System 80 & TRS 80 owners: your big chance!

Each drive has high storage capacity. 40 tracks and is suitable for both single and double density recording. Suitable for use with most computers.
Cat X-4060 Drive 0
Cat X-4061 Drive 1

WAS ~~$495.00~~
NOW ONLY **$395⁰⁰**

NEW!
Thrifty novice HF transceiver

FT 77S

Low power version of the famous FT-77 transceiver. one of the most popular Yaesu models around. Now novices can get onto HF at a low, low price. Cat D-2914

AMAZING VALUE **$599**

Limited Stock
LOUDHAILER KIT

Save a bundle! Very popular kit for all ages, easy to build. Cat K-3507

WAS ~~$29.50~~
NOW ONLY **$19⁵⁰**

Fan Drilled Heat Sink

Dissipates huge amounts of heat. Predrilled to suit TO3 transistors. 190 mm. Cat H-3424

$8⁹⁵

INCREDIBLE VALUE!

NEW DAISY WHEEL PRINTER!

At last! A quality daisy wheel printer at a realistic price. 18 c.p.s. print speed. Diablo compatible wheels means a large variety of typefaces. Prints up to 120 characters on 13 inch paper. Uses standard Centronics parallel interface.

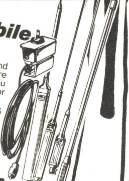
ONLY **$895⁰⁰**
Cat X-3270

Music Generator Kit!

Great for the beginner or experimenter. It uses a very special IC which is pre-programmed with two popular tunes. It also has the popular 'Ding-Dong' plus an alarm.
Cat K-3512

ONLY **$12.90**

Yaesu - HF/VHF Mobile Antenna System



The fabulous Yaesu antenna system for HF and VHF. You buy the gutter mount base and 2 metre stub, and you're on air on 2m immediately. As you want the HF bands, simply buy that band resonator antenna whip and screw it into the 2m stub.

RSM 2 – GUTTER MOUNT	Cat D-4100	$29.95
RSE 2A STUB (2M ANTENNA)	Cat D-4102	$12.95
RSL 145 – 6M/2M ANTENNA	Cat D-4104	$32.50
RSL 3.5 – 80M ANTENNA	Cat D-4110	$26.50
RSL 7 – 40M ANTENNA	Cat D-4112	$26.50
RSL 14 – 20M ANTENNA	Cat D-4114	$26.50
RSL 21 – 15M ANTENNA	Cat D-4116	$26.50
RSL 28 – 10M ANTENNA	Cat D-4118	$26.50

MORE BOOK BARGAINS

1984 Amateur Radio H'book **$19.95**

This amazing book seems to get bigger each year! This volume contains new projects for 160m, VHF power supplies and lots, lots more!
Cat B-2219

Dick Smith's Australian Semi-Conductor Handbook

This great book contains data, suggested circuits & new information on an enormous variety of commonly used devices. **$7.95**
Cat B-4200

Dick Smith Multimeter with Logic Probe

Not just a superb 20k ohms/volt multimeter with 18 ranges, it also has in-built LED's for instant recognition of high, low pulse states.
Cat Q-1026

ONLY **$32.50**

YOU REAP THE BENEFIT!

NEW!

VZ-200 SOFTWARE

SPELLOMATIC 1 & 2: Will help both children and adults learn commonly misspekt words (oops!). Cat X-7285

SPELLOMATIC 3 & 4: Similar to the above, includes the games, SPOT the GOODIE and JUMBLE DECIPHER. Cat X-7286

FLASHCARD 1 & 2: This series will help the child to learn both words and phrases by recognition. Cat X-7287

FLASHCARD 3 & 4: Similar to the above, includes specially selected phrases from the BASIC Sight List of words and common nouns. Cat X-7288

TENNIS: Play singles or doubles multi 4-level tennis game. Incredible graphics! Cat X-7264

CHECKERS: You against the computer – who will win? Different levels of play. Cat X-7265

PLANET CONTROL: Similar to Cosmic Patrol – Arcade favourite! Pilot a dune buggy, watch out for craters and obstacles. Cat X-7266

VALUE **$12.50** each

SEEING IS BELIEVING! The Dick Smith Video Enhancer

You won't believe the difference an enhancer makes to your video tape copies. Restores fine detail, lifts signal above noise level has inbuilt RF modulator so you can use with standard TV set.
Cat Y-8510

What a buy!

$129.95

NEW! ARLEC SUPERTOOL

Don't buy an ordinary PCB drill: fake a look at the new Arlec Supertool. It polishes! It cuts! It grinds! It engraves! It sands! It mills! It drills! The Fantastic Supertool makes a super hobbyist!
Cat T-4754

Great Value **$39.95**

Wow! Incredible Yaesu VFO bargain! FV-107

Superb! Will suit most transceivers and has tons of room inside!
Cat D-2870

WAS ~~$99.00~~ ONLY **$69.00**

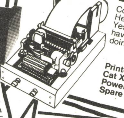
SAVE $10! 'Daisy Chain' Disk Cable

Cat X-3232

Quick for this bargain! Daisy chain cable ideal for our X-4060 & X-4061 drives (also on special!) suit System 80 or TRS-80 computer. Handles up to 4 drives.

VALUE **$39.95**

BARGAIN! SAVE $100 COMPUTER PRINTER



Computer hobbyists have never had it so good! Here's a 40 column printer for less than $150. Yes, you need to add a power supply (but we have a kit for that!) but look at the savings by doing it yourself!

VALUE AT **$149.00**

Printer (fully assembled with controller board) Cat X-3240 $149.00
Power Supply kit Cat K-3437 $36.50
Spare Ribbon to suit Cat X-3241 $4.95

BUY 5 GET ONE FREE! PLUGS & SOCKETS

YES! That's right. You buy 5 at normal price Dick will give you one extra FREE!

2.5mm Sub Mini Plug Cat P-1125 **30¢**

2.5mm Sub Mini Socket Cat P-1220 **25¢**

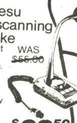
3.5mm Line Socket Cat P-1236 **40¢**

3.5mm Mono Plug Cat P-1132 (Red) Cat P-1134 (Black) **40¢**

3.5mm Mono Socket Cat P-1231 **35¢**

6.5mm Mono Socket Cat P-1261 **70¢**

SAVE $25 Yaesu YM-38 scanning mike



Goes with most transceivers-dual impedance. Comes wired with pin plug suits 757 GX and most new transceivers.
Cat C-1113

WAS ~~$55.00~~

VALUE **$29.50**

DICK SMITH Electronics

See page 143 for full address details.

A702

TAKE ADVANTAGE OF DICK'S DESPERATION!

SCOOP PURCHASE!
'Invisible' Speaker Cable System
Huge scoop purchase of unique home speaker wiring system. Under carpet, wall-paper, etc - 10m cable tape plus four plugs & sockets. Cat W-1288
OVER $10 VALUE FOR $2.95

HEAR HEAR! Parabolic Microphone Kit.
A birdwatcher's special (either feathered or skin variety!) You'll be amazed at the range a parabola gives. Cat K-3096 **$9.95**
See November EA 1983
You'll be amazed!

BUY 5 GET ONE FREE!

RCA
PLUGS
Red P-1420
Black P-1422 **40¢** (10 up 35¢)
Stereo P-1442 **75¢** (10 up 65¢)
4 WAY P-1444 **$1.25** (10 up $1.10)
2.1mm PLUG P-1641 **45¢** (10 up 40)

DIN
2 PIN LINE PLUG P-1520 **60¢** (10 up 50¢)
5 PIN LINE PLUG P-1550 **85¢** (10 up 80¢)
5 PIN PANEL SOCKET suit P-1550 P-1552 **85¢** (10 up 80¢)
5 PIN LINE SOCKET suit P-1554 **90¢** (10 up80¢)

Microphone **$3.25**
2 POLE HEAVY DUTY METAL PLUG & SOCKET P-1860

GREAT VALUE FOR PROJECTS!
240V Lead & Plug
Fantastic value for project builders. 1.8mm 3-core cable complete with moulded plug - save $$$

SCOOP PURCHASE!
MINIATURE HI-TORQUE CARBON BRUSH ELECTRIC MOTOR
This is a top-quality motor with CARBON BRUSHES, NOT cheap bronze! Size: 35mm long X 28mm dia. Would cost at least $5 anywhere else. Cat M-9950
Dick's Price ONLY 95¢

NEW LOW PRICE
Building a colour organ or light chaser?
Here is the **Spot Lite Holder**
This Spot lite holder is ideal to use with the Musicolour or Chaser Kits. Cat P-5620 **ONLY $5.95**

GREAT FOR PROJECTS!
LCD Panel Meter Kit
Versatile and accurate, LCD readout for low power consumption. Easy integration into pannels makes it ideal for amateur and professional use in projects or updating analogue equipment. Cat K-3450 **$29.50**

NEW! LET CALLER KIT
ANYONE FOR TENNIS?
When you play McEnroe he won't be able to dispute any calls! Portable, battery operated - use on any Court with wire rope for net. *Smashing value!* **$19.95** Cat K-3098

Panel lettering sets
Each packet contains hundreds of words, letters, numbers & symbols.
Size 2(2.3mm high)Black **Cat N-1800**
Size 1 (3.1mm high)Black **Cat N-1804**
(2.3mm high) White **Cat N-1806**
$6.95 EACH

NEW
FUNWAY into electronics Gift Pack
Contains Fun Way Vol.1 Book and components to build 20 pojects on our new styled 'breadboard' base (no soldering required) Now packaged in a handsome gift box for. Cat K-2605
ONLY $24.95

IT'S AMAZING
Stereo Simulator Kit

Wish those old video movies had modern stereo sound? This low-cost gadget turns almost any mono signal into amazingly good synthetic stereo! Cat K-4321 See EA April 1983
ONLY $19.95

THE DICK SMITH Magazine File

Maximum size of magazines insertions is 280mm high by 210 mm wide. Cat B-4045
VALUE! ONLY $4.50

GREAT FOR TRAVELLERS!
FULLY APPROVED
Mains Power Adaptors

Includes British 240V, European 240V & US 120V types, useful from Tahiti to Norway (Dual voltage appliances or transformer needed for 120V). Cat P-5650
ONLY $16.50

FANTASTIC BOOK VALUE

GIANT H'BOOK Electrical Circuits NOW $19.50 WAS $22.60
Everything from crystal sets to computer circuitry. You're sure to find what you want here! Cat B-1780

TTL BOOK A complete guide to Transistor Transistor logic (TTL) integrated circuits. Cat B-1248 $19.95

CMOS BOOK Everything that you need to know about CMOS. Cat B-1246 $15.50

BUY BOTH FOR $29.45 SAVE $6.00

NEW ECONOMY 2M ONLY $299 -AMAZING!

Wow! 2 meter handheld for less than $300!! That's the all-new Yaesu FT-203R - the economy handheld you can take anywhere. Incredibly easy to use with thumbwheel frequency selection, but has all the features you need including standard repeater splits, Inbuilt S-meter makes it great for fox hunts! Optional headset available shortly for full vox operation. Battery & approved charger. Cat D-2888

That's the new YAESU FT-203R

CERAMIC CAP PACK $7 VALUE

Ceramic Cap. Pack
Over 60 top quality ceramics, none less than 50VW, some as high as 630VW. Includes selection from complete range 10pF to 0.1uF. Cat R-7050
ONLY $4.75

TOP VALUE METAL FILM RESISTOR PACK WORTH $18

Metal Film Pack
Our new 1% metal film types in a computer selected pack. Now there's no excuse not to use 1% resistors in all your projects: especially at this price! Cat R-7015
ONLY $9.95

MAKE YOUR OWN PCB'S & PANELS

It's so easy to get a professional finish - even at home. Scotchcal Labels are the way: self adhesive photosensitive aluminium sheets you expose to UV light (even sunlight) develop and stick to your projects!

Exposure film Cat H-5690 .... **$6.95 per sheet.**
Red aluminum Cat H-5692
Black aluminum Cat H-5694 .... **$7.40 per sheet**
Developer (suits all) $1.40
Cat H-5696 per 50ml bottle

MICRO SWITCH...AT A MICRO-PRICE!
250V/3A SPOT Size 20mm X 100mm X 6.5mm Cat S-1922
PREMIUM QUALITY
DICK'S PRICE
(No, it's NOT a misprint!)
JUST 95c
10 UP PRICE 85c each

BEAT THE HEAT! Rotary Blower Fan
Getting a bit hot under the collar? Use one of these superb rotary fans! FANtastic for any device. Use for sucking or blowing! 240V motor.
ONLY $19.95
Cat Y-8500

JUMBO Heatshrink Tubing Pack
You asked for it... here it is! Contains 1 metre each of 5, 6.5, 9.5 & 12.5mm diam heatshrink. Almost enough to shrink a shrip! Keep some in the junk box - you never know when you'll need it. Cat W-4062
ONLY $7.50

INCREDIBLE VALUE - AMAZING SOUND!
MOSFET AMPLIFIER KIT

This 'Top of the Line' amplifier features up to the minute circuitry as well as the new MOSFET output stage. With a huge 50W/channel output, it's got everything you'll ever need in an amplifier. All components fit a single PCB, which makes construction very easy. Cat K-3515

OUR MOST POPULAR KIT!
ONLY $175

NEW Dick Smith Portable **Multimeter** with Logic Range

18 active ranges including logic high, low and pulse! 20K/V sensitivity means it's ideal for most service work, is small enough to fit in the tool box. Cat Q-1026
ONLY $32.50

The APE TAPES
Great Value & Fun

Avoid hang-ups! Use the amazing Ape Tapes. Your callers will be enjoying the voices so much, they won't hang-up. Cat Y-2172 Tape contains 12 different voices.
each $8.95

Dick Smith Electronics

See Page 143 for full address details

A703

TAKE ADVANTAGE OF DICK'S DESPERATION!

I'M SO OVER-STOCKED I'M SELLING AT DESPERATION PRICES

STOCK UP NOW FOR 1984 AT 1983 PRICES! AND LESS! MANY HUGE BULK DISCOUNTS AND LOTS OF 'GOODY PACKS'.

Your own Casino!

ELECTRONIC ROULETTE WHEEL KIT

Wow! All the fun & excitement of Las Vegas ... Wrest Point ... even Forbes St.! Now you can have a completely random roulette wheel – without the bias of commercial units! Cat K-3389

ONLY **$29.50**

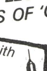
SAVE $2

Quality Dick Smith

Signal Injector

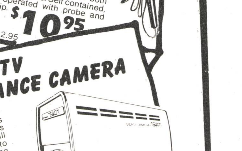
One of the handiest devices to have in your tool box! Check out both audio + RF circuits. Self contained, battery operated with probe and earth clip. Cat Q-1270 WAS $12.95

$10.95



LOW COST TV SURVEILLANCE CAMERA

Protect your property, your valuables, your children, your life! This amazing CCTV camera is ideal for nearly 99% of all general use. Use it: to monitor your swimming pool; for security monitoring in shops, banks or even around the home; as a reading aid for visually handicapped, and lots more. Outstanding value for money – don't pay between $1,000 and $20,000! Our price:



Cat Y-1195

ONLY **$399**

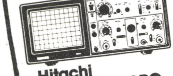
Clear Acrylic Sheet

Ideal for using over panels etc – makes your project look really professional. Or use for inspection panels, protection devices, etc. 3mm thick, 150mm long x 50mm wide. Cat H-5450

ONLY **$1**

5 up 90¢

NEW 20 MHz



Hitachi Dual Trace CRO

Not just a good CRO ... it's a great one! Top brand name with huge 20 MHz bandwidth, dual traces, extra high sensitivity ... it's got the lot! And all for our low, low price!

★ 5 display modes

★ 1 touch wave form shifting.

Cat Q-1243

$699

BACK UP SENSOR

Blind spots in your rear vision? Reverse park by the touch method? An easy to fit back up sensor lets you forget about the dings! Starts measuring at one metre! Cat A-8520

$59

SAVE $5

Now you can record

VIDEO TO VIDEO

Having trouble with video leads? No more! This incredible video lead pack will match ANY video to ANY video with its unique system. Was $19.95 Cat W-1287

$14.95

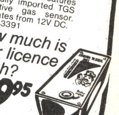
The not-so-random

BREATH TESTER

Yes! You can actually build your own breath tester! Find out how drunk you are! Features the fully imported TGS sensitive gas sensor. Operates from 12V DC. Cat K-3391

How much is your licence worth?

$29.95



Solid State Buzzer

A true electronic buzzer with hundreds of applications. Rich clear tone from such a compact unit. Cat L-7009

SAVE 33%

$1.99

Operates from 5-16V.

The Dick Smith SOLDER STATION $69

Check out the price of the Dick Smith Soldering Station. This superb station is now within reach of the hobbyist. If you're serious about good soldering, there is only one way to do it – with a temp. controlled iron such as this one. And this one you can afford! Cat T-2000

PLUS FREE TIP OF YOUR CHOICE!

SUPERB INSTRUMENT CASE

Give your projects a professional finish with a superb case. Ideal for projects using LED displays etc. PCB slots into case with LEDs showing through front panel. Red perspex front. 104 x 44 x 68mm.
Cat H-3194

$4⁹⁹

10 up $4.55

Printed Stripboard

High quality silver plated copper strip board similar to the English Veroboard. Continuous pre-drilled stripping on a high grade insulator. Packed in plastic sheets to assure you an untarnished, easy to solder surface. 95 x 304mm.
Cat H-5112

AMAZING VALUE! **$4⁹⁵**

10 up $4.50

NEW IMPROVED MODEL!

Masthead Amp.

At last there's a masthead amplifier which can improve your TV reception at a low cost. Ideal for fringe areas, it's designed specifically to suit Australian TV & FM characteristics.

Cat L-4200 **$42**

Was $49.50

DICK'S VALUE PACKS

Polyester
60 top quality greencaps, 100V rating. .001 to 0.22 uF.
Cat R-7040
$8.95

Electrolytic Cap
55 single ended electrolytics. 2.2 – 470uF, 10 – 25V. Terrific value!
Cat R-7030 **$6.75**

Resistor
300 ¼ watt types worth $12. 60 values, quality 5% types.
Cat R-7010
$5.90

50 MATRIX PINS

Make soldering easier with these push-through pins. Suits 2.54mm pitch matrix board or veroboard.
Cat H-5590

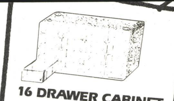
$1⁶⁵ pk. of 50

TV AERIALS & ACCESSORIES

L-4020 UHF/VHF TV Antenna	**$59.95**
L-4022 Antenna	**$49.95**
L-4028 UHF TV Antenna	**$21.95**
L-4150 Barge Mount	**$9.00**
L-4152 TV Mount	**$5.95**
L-4153 TV Mount & Clamp	**$6.95**
L-4154 TV Chimney Mount	**$14.95**
L-4156 TV Acc. Mast Section	**$7.50**
L-4165 U-Bolt	**$1.55**
L-4218 300 ohm 2-way splitter	**$2.85**
L-4270 TV Splitter 75 OHM 2-way	**$1.80**

Remember

it's a known fact – Antennae hold up houses! So get your new aerial today, before your house falls down!

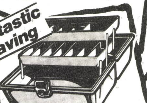


16 DRAWER CABINET

$19⁹⁵

Clean up your workroom – Why not put those bits 'n pieces into usable order? Much easier to find! This cabinet of drawers is ideal for small components, screws, nuts & bolts. And it's ideal for the work-bench because it's so compact.
Cat H-2588

Fantastic Saving



DELUXE TOOL/WORKBOX

Don't spend hours searching for things anymore – know where they are at a glance! You'd be amazed just how much this will hold! Large enough for soldering irons: plus compartments small enough for components etc. Ideal for artists, fishermen, hobbyists, technicians etc. Cat H-2600

$29⁵⁰

Was $32.50

Amaze your friends

Electronic Door Chime Kit

A different tune every time you press the doorbell! Yes! This door chime, based on the latest microprocessor technology will play over 20 tunes, (or just one should you have a preference!) Great fun to build and use.
Cat K-3502

ONLY $31

No trailing wires!

Stereo headset AM/FM radio

Here they are – radio headphones with NO messy wires to get in the way. Fantastic quality for a low, low price. Receives AM & FM. Ideal for joggers, cyclists, commuters, anyone!
Cat A-4335

$34⁹⁵

Build your own LED Tacho

Don't spend a fortune buying a tachometer – build your own and save! Displays engine speed in an analogue form in an illuminated row of LEDs. Instructions included – a great kit! Cat K-3240

$24⁵⁰

DRASTIC REDUCTION SAVE ALMOST 50%!

WAS $4.95
NOW **$2⁵⁰**

Project Cases

Give your project that added touch of professionalism with one of these deluxe project cases. Make it a project you'll be proud of!
Cat H-3107
55(h) x 168(l) x 124(w) mm.

BUY 5 GET ONE FREE!

Yes! That's right! You buy 5 at the normal price – Dick will give you one extra free!

Banana
4mm plugs
RED P-1710
BLACK P-1712
YELLOW P-1714
35¢ *(10 up 30¢)*

Quick Connect
Quick Connect P-5012
95¢ *pk of 10 (10 up 85¢)*
Cover for P-5012 **95¢** *pk of 10 (10 up 85¢)*
P-5022

6.5mm Stereo Plug P-1166
95¢ *(10 up 85¢)*

6.5mm Stereo Socket P-1266
80¢ *(10 up 72¢)*

6.5mm Line Sockets
Mono P-1264
80¢ *(10 up 72¢)*
Stereo P-1286
85¢ *(10 up 75¢)*

The Ham Exam Cram Book

$4⁹⁵

Sharpen your knowledge and prepare for your theory exam without wasted effort! Concisely explained examples plus many multiple choice questions and answers.
Cat B-2314

Dick Smith Electronics

See Page 143 for full address details

A704

WAVETEK®

- **NETWORK ANALYZERS**
- **INSTRUMENTATION COMPUTER**
- **REAL TIME SPECTRUM ANALYZERS**
- **SIGNAL PROCESSING FILTERS**
- **FREQUENCY SYNTHESIZERS**
- **FUNCTION GENERATORS**
- **PROGRAMMABLE FUNCTION GENERATORS**
- **PULSE GENERATORS**
- **MICROWAVE SIGNAL GENERATORS**
- **SWEEP GENERATORS**
- **SIGNAL GENERATORS**
- **MOD METER, ANALYZER AND SERVICE MONITORS**
- **DISPLAY OSCILLOSCOPES**
- **RF AND MICROWAVE COMPONENTS**
- **BROADBAND CATV TEST EQUIPMENT**

NEW APPOINTMENT

Commencing on the 25th day of December, 1983, Scientific Devices Australia Pty. Ltd. was appointed as the new Australian representative for Wavetek Corporation U.S.A.

Wavetek made this appointment after many months of assessing and negotiation with both Scientific Devices and other leading instrumentation representatives. The now allows Scientific Devices to offer one of the largest and most comprehensive electronics instrumentation product lines in Australia.

Wavetek, with the addition of two new divisions to their structure, namely Nicolet Scientific Corporation and Pacific Measurements, are one of the largest instrumentation suppliers in the U.S.A.

Their products include F.F.T. analyzers, synthesizers, programmable filters, R.F. signal generators, R.F. components, communication service monitors, radio and C.A.T.V. test equipment, R.F. sweep generators, microwave generators, instrumentation controllers, pulse/function generators, arbitrary programmable generators, instrument controllers, network analyzers and power meters.

From the 25th December, 1983, Scientific Devices offer marketing and support for Wavetek products with full service facilities.

Please contact Scientific Devices Australia Pty. Ltd. for further information on this appointment at any one of the offices in Melbourne, Sydney or Adelaide.

Scientific Devices Australia Pty. Ltd.

2 Jacks Road, South Oakleigh 3167. Phone: 579 3622
31 Halsey Road, Elizabeth East, S.A. 5112 Phone: 255 6575
35-37 Hume St., Crows Nest., N.S.W. 2065 Phone: 43 5015

LOW COST 650 MHz COUNTER

NEW from Global Specialties, the Model 6001 is a benchtop 650 MHz frequency counter offering a very wide range of facilities, including dual inputs, switch-selectable gate times, and the use of both internal and external timebases for transducer, tachometry and flow-metering applications as well as general-purpose frequency measurements.

The instrument is designed for flexibility and ease of use, with a minimum of front-panel controls and comprehensive input and output facilities to suit a variety of applications.

The 6001 covers a frequency range from 5 Hz to 650 MHz; one of the two front-panel BNC inputs is used for signals from 5 Hz to 100 MHz, and the other covers the range 50 MHz to over 650 MHz.

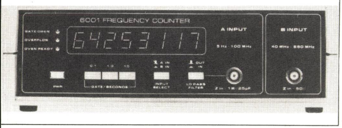
The lower-frequency input has a quoted input impedance of 1M + 10pF, with a switchable low-pass filter providing 3 db/octave roll-off at 50 kHz for audio and ultrasonic measurements, while the higher-frequency input provides a 50 Ohm input impedance and fuse protection.

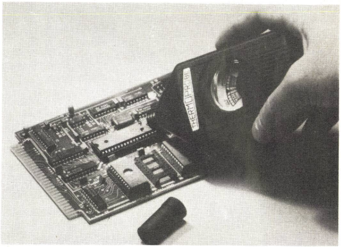
Three switch-selectable gate times are offered: 0.1, 1.0 and 10 sec, giving resolution sof 10, 1 and 0.1 Hz, respectively. A light-emitting diode on the front panel indicates a 'gate-open' condition.

The 8-digit, 11mm high display offers lead-zero blanking, a decimal point in the megahertz position and a contrast enhancement filter to ensure legibility in high ambient light environments. Other front-panel indicators are provided for 'oven-ready', 'overflow' and 'power-on'.

The internal timebase is a precision 10 MHz oven-controlled crystal oscillator, with a claimed accuracy of +/−0.5 parts per million from 0° to 50° Celcius. The external reference can be selected with a rear-panel switch. The oven-oscillator output is buffered, and is available via a rear-panel BNC connector. Inputs and outputs are compatible with standard TTL circuitry.

The global Model 6001 is mains-powered, measures 76 x 254 x 178 mm and weights just 1.4 kg. It comes with a comprehensive instruction and applications manual. Global Specialties is represented by **Vicom International, 57 City Rd., South Melbourne 3205. Vic. (03)62-6931.**





THERMOPROBE TESTS PCBs

A new, low cost, electronic test instrument called Thermoprobe is designed to quickly identify dead active components on printed circuit boards without direct contact.

The solid-state device consists of a thermistor probe connected to a modified wheatstone bridge circuit and is designed to measure minute temperature changes of 1/25 of a degree Fahrenheit (1/45°C).

Since dead resistors, transformers, diodes or ICs do not emit heat they can be quickly identified on the unit's built-in S-meter as the thermistor probe is moved in close proximity to them, claim the manufacturers, Metrifast.

Its small shirt pocket size makes the device extremely useful in field service applications for computers, electronic instrumentation, video and hi-fi equipment.

The Metrifast Thermoprobe is available for US$21.95 postpaid from **Metrifast, 51 South Denton Avenue, New Hyde Park, New York 11040 USA.**

DIGITAL MULTIMETERS MEASURE CAPACITANCE

Lamron is marketing hand held and bench model digital multimeters which give the facility to measure capacitors and conductance or transistors and conductance.

The hand held models have a high resolution 12.5 mm LCD which is visible from acute angles and two types of range selection. Models 56 and 58 use a single rotary switch and models 73, 76 and 79 use push buttons.

A 9 V battery provides approximately 200 hours operation, with low battery voltage automatically detected and displayed. Each range has full auto-polarity operation and overrange indication, while dual slope integration measurement techniques ensure noise-free measurements.

The models capable of measuring capacitance have five range scales and are able to measure up to 20 µF, offering accuracies to 0.1% on dc. With a high impedance of 10M, these instruments are ideally suited to the designer's test bench.

These units are capable of reading from 1 µA to 10 A on the ac and dc ranges, and can make resistance measurements up to 10 000M using the conductance ranges.

A six month guarantee is provided on all models. The hand held units are supplied with a soft carry case, test leads, spare fuse, instruction manual and battery.

For further information contact **Lamron Pty Ltd, P.O. Box 438, Ryde NSW 2112. (02)85-6228.**

AUDIO TEST SET

The Loftech TS-1 from Phoenix Audio Laboratory, is a compact device that combines an audio sine wave generator with a digital meter.

The oscillator's range extends from 15 Hz to 30 kHz, and the meter can be switched to read decibel levels as well as frequencies.

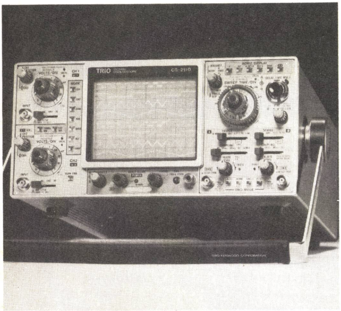
When switched for signal level, the meter reads whole decibels over a range of −50 to +24, with 0 dB representing 0.775 V. The minus sign comes on automatically as applicable. A rear panel adjustment may be used to adjust the 0 dB reference point.

In its frequency display mode, the meter responds from 1 Hz to 99.99 kHz.

It's possible to use the TS-1 simultaneously as both a test signal source and a readout device for other equipment being tested.

Suggested uses of the Loftech TS-1 include calibrating levels of tapes and mixing consoles, verifying the frequency response of audio equipment and checking signal levels at various points in an audio chain as a troubleshooting aid.

For further information contact **John Vestergaard, Hilotek International Pty Ltd, Miles St, Mugrave Vic. 3170. (03)561-2888.**



NEW TRIO SCOPE ▲

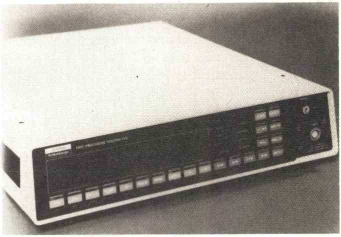
Parameters recently released the new Trio CS-2110 100 MHz portable oscilloscope. The new model replaces the older CS-2100A and features thoroughly upgraded performance in virtually all areas, the company said.

Parameters claims the CS-2110 is capable of observing extremely low signal levels with complex waveforms. Sensitivity is 1 mV/div up to 100 MHz and the -6 dB bandwidth point is guaranteed to 140 MHz, they said.

Utilising the alternate delayed sweep technique, a user can view all four channels and their corresponding delayed signals simultaneously. This gives a total of eight traces. Sweep time is continuously variable from 0.5 seconds to 20 nanoseconds per division.

An internal delay line enables observation of the leading edge of high frequency signals. The CRT has 20 kV of accelerating potential with automatic focus Accuracy is ±2%. The package housing the scope is 284 mm x 138 mm x 400 mm and weighs 7.4 kg, which is reasonably light.

Further information can be obtained from **Parameters Pty Ltd, PO Box 573, Artarmon NSW 2064. (02)439-3288.**



NEW COUNTERS ▲

Tech Sales has announced the release of the Solartron 7081, which they claim to be the most advanced digital voltmeter in the world.

The 7081 provides less measurement uncertainty and better stability than any other product, they say.

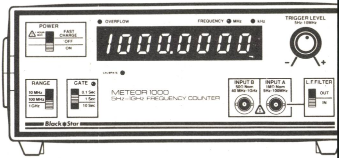
It is the first voltmeter with 8½-digit scale length, having a sensitivity of 10 nV. This, coupled with various methods of digital filtering enables measurements to be made that have not been possible in the past.

As well as having 8½-digit scale length, the 7081 has 1.2 ppm dc stability for 24 hours, a typical uncertainty of 11 ppm for one year, true rms ac measurement, and resistance measurement to greater than 1400M

Added to this, is the comprehensive result processing, measurement history file and full control via RS232C or IEEE-488 interfaces, which means the product can fulfil the requirements of a standards laboratory and automatic test, yet still be appropriate for straightforward bench use.

The system capability is enhanced by an automatic measurement clock and an option 128 channel analogue scanner.

For further information, contact **Tech Sales Pty Ltd, 83-87 Wellington St, Windsor Vic. 3181 (03)51-1306.**



ADVANCED DVM

Hilotek has become the Australian agent for Black Star frequency counters and three models in the range are available.

All of them have eight-digit seven-segment LED displays and operate on 9 V dc. Mains adaptors are supplied but Ni-Cad batteries are optional. Frequency ranges are: Meteor 100, 5 Hz to 100 MHz; Meteor 600, 5 Hz to 600 MHz; an Meteor 1000, 5 Hz t 1000 MHz.

As an introductory offer these instruments are priced a $256, $305 and $355 respectivel (plus sales tax where applicable). Further information i available from **Hilotek International Pty Ltd, Miles St, Mulgrave Vic 3170 (03)561-5888.** ●

LESS 20% FOR 25 OR MORE OF ONE TYPE OF IC OR TRANSISTOR THIS MONTH.

Integrated Circuits & Transistors

2N3819	1.20
2N3866	2.95
2N3904	1.00
2N3906	1.00
2N4030	1.50
2N4032	2.20
2N4033	2.20
2N4036	2.50
2N4121	1.50
2N4123	1.50
2N4236	1.90
2N4237	1.90
2N4248	.40
2N4249	.40
2N4250	.40
2N4258	.50
2N4355	.50
2N4356	.50
2N4360	1.00
2N4401	.30
2N4402	.30
2N4403	.30
2N4416	1.90
2N4427	2.90
2N4919	2.90
2N5088	1.00
2N5089	1.00
2N5139	1.20
2N5179	1.20
2N5190	2.50
2N5191	3.30
2N5192	3.10
2N5193	2.50
2N5194	2.95
2N5195	3.30
2N5210	1.50
2N5245	1.50
2N5303	8.50
2N5401	1.50
2N5457	1.00
2N5458	.90
2N5459	.90
2N5461	.90
2N5462	.90
2N5485	.90
2N5486	.90
2N5489	14.50
2N5590	16.50
2N5591	18.50
2N5641	19.50
2N5656	2.50
2N5770	.30
2N5777	1.50
2N5830	.30
2N5831	.30
2N5873	1.40
2N5874	1.70
2N5944	15.50
2N5945	18.50
2N5946	19.50
2N5961	1.90
2N6027	1.00
2N6049	1.90
2N6080	8.50
2N6083	17.90
2N6084	22.50
2N6124	1.90
2N6125	1.90
2N6130	1.90
2N6133	1.90
2N6256	14.50
2N6259	13.50
2N6274	29.50
2N6378	4.90
2N6425	4.50
2N6578	5.90
3N201	1.50
2SA683	2.95
2SC2028	3.95
2SC2029	3.95
2SC2166	4.95
2SC1730	1.95
2SC1969	6.30
2SC1973	3.95
VN88AF	3.95
2SC372	1.95
2SC495	2.95
2SC710D	1.95
2SC735	1.95
2SC900F	1.95
2SC945A	1.95
2SC1014	2.50
2SC1017	4.95
2SC1018	4.95
2SC1061	2.95
2SC1096	2.95
2SC1173	2.95
2SC1226	2.95
2SC1306	6.30
2SC1419	2.95
2SC1449	1.95
2SC1674	1.95
2SC1675	1.95
2SC1307	6.90

2SD288	3.95
2SD325	2.95
2SD525	3.95
2SK45	3.95
2SJ49	7.50
2SJ56	12.50
2SK45	3.95
2SK134	7.50
2SK176	12.50
1N4001	.10
1N4002	.15
1N4007	.20
1N5400	.40
1N5404	.40
1N5408	.60
OA47	.80
OA90	.50
OA91	.50
OA95	.50
5082-2800	2.95
5082-2811	4.95
HLMP6620	5.95

BRIDGES

1.5AMP	
W005	.50
W02	.60
W04	.60
6AMP	
BPC602	2.90
KBPC604	3.50
KBPC608	4.50
10AMP	
KBPC10005	3.90
KBPC1002	4.20
KBPC1004	4.90
35AMP	
KBPC3502	5.90
KBPC35014/MD A3504	6.90
KBPC3510/MDA 3510	9.90

74

7400	.60
7401	.60
7402	.60
7403	.60
7404	.60
7405	2.00
7406	2.00
7407	2.00
7408	.60
7409	.60
7410	.60
7411	.70
7412	.70
7413	.70
7414	1.20
7415	.70
7416	1.20
7417	1.20
7420	.60
7421	.80
7422	.80
7423	.90
7425	.90
7426	.70
7427	.80
7428	.80
7430	.70
7432	.70
7433	.70
7437	.80
7438	.90
7439	1.00
7440	1.00
7442	1.00
7443	1.60
7444	1.50
7445	1.50
7446	1.20
7447	1.20
7448	1.20
7449	1.20
7450	.90
7451	.90
7452	.80
7453	.70
7454	.80
7455	.90
7460	.70
7461	.90
7462	1.00
7463	1.20
7470	.80
7472	.90
7473	.90
7474	.70
7475	.70
7476	.80
7477	1.20
7478	1.20
7480	1.20

7482	1.80
7483	1.10
7485	1.20
7486	1.20
7489	3.90
7490	1.00
7491	1.00
7492	1.00
7493	1.00
7494	1.50
7495	1.00
7496	1.50
7497	2.30
74100	1.65
74107	1.20
74109	.90
74110	1.50
74111	1.50
74112	1.50
74113	1.50
74114	1.50
74120	1.95
74121	.90
74122	.90
74123	1.50
74125	1.00
74126	1.00
74128	1.80
74132	1.00
74136	1.00
74138	1.80
74139	1.50
74141	1.10
74142	1.45
74143	1.45
74144	3.90
74145	1.45
74147	1.95
74148	2.00
74150	1.50
74151	1.20
74154	1.75
74155	1.20
74156	1.70
74157	1.00
74158	1.00
74160	1.00
74161	1.20
74162	1.20
74163	1.40
74164	1.20
74165	1.20
74166	1.70
74167	2.20
74174	1.45
74175	1.20
74176	1.40
74177	1.40
74178	2.15
74179	2.15
74180	1.20
74182	1.20
74184	1.20
74190	1.00
74191	1.45
74192	1.65
74193	.80
74194	1.10
74195	1.00
74196	1.20
74197	1.10
74198	1.10
74199	1.30
74221	1.90
74240	2.90
74241	2.90
74242	2.40
74243	1.90
74244	1.90
74245	2.40
74246	2.25
74247	2.25
74248	2.25
74249	2.25
74251	1.10
74253	1.10
74257	1.50
74258	1.50
74249	2.45
74273	2.45
74276	2.45
74278	3.45
74279	.85
74283	2.45
74289	3.25
74290	.90
74293	.90
74295	1.65
74298	2.45
74299	1.75
74351	1.85
74352	1.85
74365	1.50
74366	1.50

74367	1.50
74368	1.50
74373	2.25
74374	2.25
74375	1.75
74377	2.45
74390	1.95
74393	1.95
74425	2.55
74226	2.55
74490	2.65
9300	1.50
9301	2.50
9302	2.90
9304	4.00
9305	2.40
9307	3.80
9308	2.60
9309	2.40
9310	1.50
9311	2.50
9312	2.50
9313	6.00
9314	2.40
9316	1.90
9317	4.20
9318	4.60
9319	2.00
9320	6.90
9321	2.40
9322	1.90
9324	1.40
9328	4.90
9334	6.00
9338	5.90
9340	9.90
9342	5.90
9368	2.20
9374	3.30
9386	2.40
75107	2.50
75110	2.50
75150	2.50
75154	2.50
75450	1.50
75451	.90
75452	.90
75453	.90
75461	1.50
75462	1.50
75471	3.00
75472	3.00
75491	2.00
75492	2.00
75493	3.00
75494	3.00
8121	5.00
8123	4.00
8130	7.95
8131	7.95
8135	6.95
8136	6.95
8303	5.50
8304	6.95
82S23	5.95
82S123	6.95
8311	5.95
8641	5.95
8820	6.95
8830	6.95
8831	6.95
8832	6.95
8833	6.95
8834	6.95
8835	5.95
8836	3.75
1488	1.50
1489	1.50
81LS95	2.75
81LS96	2.75
81LS97	2.75
81LS98	2.75
8T26	3.00
8T28	3.00
8T30	3.00
8T96	1.80
8T97	1.80
8T13	2.95
8T14	2.95
8080	8.00
8085	8.50
8086	59.00
8088	29.00
8155	6.50
8156	11.50
8185	37.50
8202	52.50
8203	58.50
8206	115.50
8212	3.00
8214	4.90
8216	3.00
8224	3.50
8226	4.90

8228	5.50
8231	199.00
8232	199.00
8237	39.00
8238	9.50
8243	8.50
8251	4.90
8253	7.50
8255	5.50
8257	16.50
8259	6.50
8271	89.00
8272	33.00
8273	65.00
8274	42.50
8275	38.50
8276	28.50
8379	8.50
8282	6.90
8283	6.50
8284	8.50
8286	6.50
8287	6.50
8288	25.00
8289	73.00
8291	43.00
8292	34.50
8293-10	26.50
8741	57.50
8748	35.00
8749	58.50
8755	33.50
2911	26.50
2912	27.50
2920	239.00
3205/8205	9.90
3242	17.50
3245	10.90
3628	18.50
8008-1	62.50
8031-3	29.50
8035	6.90
8039	7.90
FD1771	19.00
FD1791 (8876)	39.00
FD1793 (8877)	39.00
FD1795	39.00
FD1797	39.00
WD1691	29.50
WD2143	14.50
WD1931	22.50
WD1933	34.00
WD1983	14.75
WD1993	59.00
WD2123	26.50
WD8250	16.50
TR1602 (S1883)	8.50
TR1863	8.90
COM8116	24.00
BR1941	23.00
CRT8002A	59.90

74F SERIES

74F00	.79
74F02	.79
74F04	.92
74F08	.79
74F10	.79
74F11	.79
74F20	.79
74F32	.79
74F64	.79
74F74	.89
74F86	1.19
74F109	.99
74F138	1.79
74F139	1.79
74F151	1.79
74F153	1.79
74F157	1.79
74F158	1.79
74F175	2.78
74F181	5.98
74F182	2.73
74F189	7.44
74F190	4.86
74F191	4.86
74F194	2.41
74F241	3.72
74F243	4.34
74F244	3.72
74F251	1.93
74F253	1.93
74F257	1.93
74F258	1.93
74F350	4.34
74F352	1.93
74F353	1.93
74F373	4.84
74F374	4.84
74F399	2.78

74F521	4.22
74F533	4.84
74F534	4.84

MEMORY

2101	6.90
2102	2.50
2112	7.90
2114	2.95
3147	6.90
2708	5.90
2716	5.90
2732	7.00
2764	12.00
27128	59.00
4116	3.95
4164	10.00
6116	10.00
6164	99.00
58725 (6116)	9.00
2101 (5101) (8101)	7.90
5101	7.90
8101	7.90
2532	12.50

OPTO

4N25	1.20
4N26	1.20
4N27	1.20
4N28	1.20
4N29	1.50
4N30	1.60
4N32	2.50
4N33	2.50
4N35	2.50
4N37	2.00
MCT6	2.50
MCT66	6.90
MCT2	1.50
1LD 74	5.90
1LQ 74	6.50
FND357	1.80
FND500	1.80
FND507	1.80
FND800	3.50
TIL31A	2.95
TIL81A	2.95
TIL306	14.50
MAN72 (DL702)	2.50
MAN74 (DL704)	2.50
BPW50	2.25
HP5082-2811	4.95
HLMP 6620	3.95
CQY89	1.50
MOC3011	2.95
MOC3020	2.50
MOC3021	2.95
LEDS	
3mm RED	.25
3mm YELLOW	.30
3mm GREEN	.30
5mm RED	.15
5mm YELLOW	.30
5mm GREEN	.30
ITEM	
RETAIL COST	
5mm ORANGE	.30
RED RECT	.30
GREEN RECT	.30
YELLOW RECT	.30
RED CHROME BEZEL	1.20
YELLOW CHROME BEZEL	1.20
GREEN CHROME BEZEL	1.20

VOLTAGE REGS

78050C	1.20
7805KC	2.50
7812UC	1.20
7812KC	2.50
7815UC	1.20
7815KC	2.50
7818UC	1.20
7818KC	2.50
7824UC	1.20
7824KC	2.50
7905UC	1.90
7905KC	3.00
7912UC	1.90
7912KC	3.00
7915UC	1.90
7915KC	3.00
7918UC	1.90
7924UC	1.90
78L 05	.75

78L12	.75
78L 15	.75
78L 18	.75
78L 24	.75
79L 05	1.20
79L 12	1.20
79L 15	1.20
79L 18	1.20
79L 24	1.20
LM309K (7805KC)	1.90
LM317T	2.50
LM317K	4.50
LM317HV	9.50
LM323K	6.50
LM337T	2.90
LM337K	6.50
LM338K	9.50
LM350T	6.50
LM350K	7.50
LM395K	22.50
LM396K	19.50
78H 05KC	9.00
78H 12KC	9.00
78HGKC	9.50
78P 05KC	14.50
ITEM	
RETAIL COST	
79HGKC	16.50
78S 40	3.50
MC1496L	14.50

SPECIAL FUNCTION

LM 4250	2.45
NE5534 N	2.50
NE5534 AN	2.95
MC3340	1.90
MC3341	2.90
76477	8.95
76488	8.95
76489	9.95
8038	6.50
OM350	9.95
IM65X08CPE	5.00
XR2206	7.95
XR2207	7.95
XR2208	6.90
XR2209	6.90
XR2211	7.45
XR2216	5.90
XR2240	6.95
XR2243	7.95
XR8038	7.50
ICC7660	12.50
95H90	8.50
11C90	16.50
LM7555	1.90
LM7556	3.50
MC10116L	1.50
LM13600	3.95
LF13741	.80
LF13741-H	1.50
DS75451	.60
DS75452	.60
DS75491	2.00
DS75492	2.00
DM2502	12.50
ADC080	16.00
ADC808	17.00
DAC0800	4.50
DAC0808	4.50
SAK140	9.50
ZN414	1.95
UA170	5.95
4000	.60
4001	.60
4002	.80
4006	1.90
4007	.80
4008	1.70
4009	.90
4010	.90
4011	.60
4012	.90
4013	1.20
4014	1.90
4015	1.20
4016	1.00
4017	1.50
4018	1.90
4019	.80
4020	1.50
4021	1.50
4022	1.50
4023	.75

4024	1.20
4025	.80
4026	2.40
4027	1.20
4028	1.20
4029	1.50
4030	1.50
4031	2.95
4032	2.75
4033	2.75
4034	3.50
4035	1.95
4038	3.25
4040	1.90
4041	1.50
4042	1.00
4043	1.60
4044	1.20
4045	4.90
4046	2.50
4047	1.90
4048	1.20
4049	1.00
4050	1.00
4051	1.50
4052	1.50
4053	1.50
4054	3.90
4055	3.90
4056	4.20
4060	2.50
4063	2.00
4066	2.50
4067	9.90
4068	1.00
4069	1.00
4070	.90
4071	.80
4072	.90
4073	.90
4075	.90
4076	1.50
4077	.80
4078	.80
4081	.80
4082	.80
4085	2.20
4086	2.30
4089	3.50
4093	.75
4094	3.35
4095	2.40
4096	2.40
4097	6.50
4098	2.90
4099	3.90
4104	6.90
4160	1.25
4161	1.25
4162	1.25
4163	1.25
4174	1.25
4175	1.60
4194	1.95
4402	1.00
4404	1.15
4408	6.90
4409	13.50
4410	11.50
4411	12.60
4412	5.45
4415	10.15
4416	5.60
4419	3.45
4422	9.50
4426	2.35
4428	1.75
4433	2.75
MC14433	13.90
4435	7.95
4441	1.50
4443	3.90
4445	2.65
4446	3.55
4449	1.00
4450	3.75
4451	3.75
4457	5.90
4458	9.90
4469	14.90
4490	5.90
4495	3.95
4500	8.90
4501	.50
4502	1.80
4503	.90
4504	2.00
4506	.75
4507	.40
4508	4.50
4510	1.50
4511	1.50
4512	1.10
4513	2.65

4514	2.90
4515	2.90
4516	1.45
4517	8.75
4518	2.50
4519	1.90
4520	2.55
4521	3.90
4522	1.90
4526	1.85
4527	2.65
4528	1.15
4529	1.80
4530	1.60
4531	1.65
4532	2.65
4534	8.90
4536	6.50
4538	3.50
4539	1.65
4541	1.60
4543	2.50
4544	10.50
4549	7.25
4551	1.80
4553	5.50
4554	2.35
4555	1.10
4556	1.25
4557	7.85
4558	2.25
4559	7.25
4560	3.75
4561	1.80
4562	8.45
4566	3.00
4568	4.25
4569	2.50
4572	.75
4580	8.95
4581	3.10
4582	2.25
4583	1.65
4584	.85
4585	2.10
4597	
4599	3.45
45104	7.25
45106	7.85
45107	7.25
45109	7.25
45112	7.85

RESISTOR PACKS

SIPS RESISTORS
PIN 1 COMMON
6 PIN

R27100 100 OHM	1.20
R27105 220 OHM	1.20
R27110 330 OHM	1.20
R27115 470 OHM	1.20
R27120 560 OHM	1.20
R27125 820 OHM	1.20
R27130 1K OHM	1.20
R27135 1K2 OHM	1.20
R27140 1K5 OHM	1.20
R27145 1K8 OHM	1.20
R27150 2K2 OHM	1.20
R27155 2K7 OHM	1.20
R27160 3K3 OHM	1.20
R27165 4K7 OHM	1.20
R27170 5K6 OHM	1.20
R27175 6K8 OHM	1.20
R27180 8K2 OHM	1.20
R27185 10K OHM	1.20

8 PIN SIPS

R28100 100 OHM	1.40
R28105 220 OHM	1.40
R28110 330 OHM	1.40
R28115 470 OHM	1.40
R28120 560 OHM	1.40
R28125 820 OHM	1.40
R28130 1K OHM	1.40
R28135 1K2 OHM	1.40
R28140 1K5 OHM	1.40
R28145 1K8 OHM	1.40
R28150 2K2 OHM	1.40
R28155 2K7 OHM	1.40
R28160 3K3 OHM	1.40
R28165 4K7 OHM	1.40
R28170 5K6 OHM	1.40
R28175 6K8 OHM	1.40
R28180 8K2 OHM	1.40
R28185 10K OHM	1.40

10 PIN SIPS

R29100 100 OHM	1.60
R29105 220 OHM	1.60
R29110 330 OHM	1.60
R29115 470 OHM	1.60
R29120 560 OHM	1.60
R29125 820 OHM	1.60
R29130 1K OHM	1.60
R29135 1K2 OHM	1.60
R29140 1K5 OHM	1.60
R29145 1K8 OHM	1.60
R29150 2K2 OHM	1.60
R29155 2K7 OHM	1.60
R29160 3K3 OHM	1.60
R29165 4K7 OHM	1.60
R29170 5K6 OHM	1.60
R29175 6K8 OHM	1.60
R29180 8K2 OHM	1.60
R29185 10K OHM	1.60

Errors & omissions excepted.

LESS 10% THIS MONTH FOR 10 OR MORE OF ONE TYPE OF IC OR TRANSISTOR.

Integrated Circuits & Transistors

REVISED 7/11/83

ICL7106	13.50
ICL7116	19.50
ICL7117	21.50
ICL7611	6.95
ICL7612	6.95
ICL7660	4.90
ICL7663	4.90
ICL7664	4.90
ICM7211	12.50
ICM7216A	48.50
ICM7216B	44.50
ICM7217A	18.50
ICM7218A	18.50
ICM7224A	21.50
ICM7226A	48.50
ICM7227A	19.95
ICM7213A	15.50
ICM7240	7.50
ICM7242	3.90
ICM7250	7.90
ICM7260	7.90
ICM7555	2.75
ICM7556	2.95

74 S

74S00	1.00
74S02	1.00
74S03	1.00
74S04	1.00
74S05	1.50
74S08	1.00
74S09	1.50
74S10	1.00
74S11	1.00
74S15	1.60
74S20	1.20
74S22	1.50
74S30	1.00
74S32	1.00
74S37	1.70
74S38	1.70
74S40	1.20
74S51	.80
74S64	1.20
74S65	1.20
74S74	1.30
74S86	1.60
74S109	2.50
74S112	1.30
74S113	1.30
74S114	2.50
74S124	5.90
74S132	3.50
74S133	1.20
74S134	1.40
74S135	1.30
74S138	3.30
74S139	3.30
74S140	1.90
74S151	3.10
74S153	2.00
74S157	3.10
74S158	3.10
74S160	5.90
74S161	5.90
74S162	7.90
74S163	7.90
74S168	11.50
74S169	11.50
74S174	4.50
74S174	4.50
74S181	8.50
74S182	3.40
74S188AN	4.10
74S189	8.50
74S194	3.30
74S195	2.90
74S196 82590	4.90
74S197 82591	4.90
74S201	9.90
74S214AN	P.O.A
74S225	10.90
74S226	7.90
74S240	6.90
74S241	6.90
74S244	9.90
74S251	3.90
74S253	4.90
74S257	3.30
74S258	3.30
74S260	2.90
74S274	P.O.A.
74S275	P.O.A.
74S280	5.90
74S281	P.O.A.
74S283	7.90
74S287	4.90
74S288	4.90
74S299	13.90
74S301	13.90
74S314	P.O.A.
74S330	P.O.A.
74S331	P.O.A.
74S373	9.90
74S374	9.90
74S381	9.90
74S387	3.30
74S412 8212	5.90
74S428 8228	7.90
74S470	9.90
74S471	9.90
74S472	P.O.A.
74S473	P.O.A.
74S474	P.O.A.
74S475	P.O.A.
74S482	11.90
74S489	7.90

74H

74H00	.80
74H01	.80
74H02	.80
74H03	.80
74H04	.80
74H05	.90
74H08	1.10
74H10	.80
74H11	.80
74H12	.80
74H15	.80
74H20	.80
74H21	.90
74H22	.80
74H30	.90
74H40	.90
74H50	.90
74H51	.90
74H52	.90
74H53	.90
74H54	.90
74H55	.90
74H60	.90
61	.90
74H62	.90
74H64	.90
74H65	.90
74H71	1.40
74H72	1.20
74H73	1.80
74H74	1.80
74H76	1.90
74H78	1.90
74H87	7.90
74H101	1.80
74H102	1.80
74H103	2.50
74H106	2.50
74H108	2.50
74H113	1.10
74H114	1.10
74H183	7.90

74C

74C00	.80
74C02	.80
74C04	.80
74C08	.80
74C10	.80
74C14	1.00
74C20	.80
74C30	.80
74C32	.80
74C42	1.90
74C48	2.50
74C73	1.40
74C74	2.40
74C76	1.90
74C83	2.30
74C85	2.30
74C86	1.50
74C89	8.90
74C90	1.90
74C93	1.90
74C95	2.00
74C107	1.20
74C150	6.50
74C151	4.20
74C154	6.00
74C157	3.75
74C160	1.90
74C161	1.90
74C162	2.00
74C163	2.00
74C164	2.50
74C165	2.50
74C173	1.90
74C174	1.90
74C175	1.90
74C192	2.00
74C193	2.00
74C195	2.00
74C200	14.00
74C221	2.75
74C240	2.75
74C244	2.95
74C373	5.75
74C374	5.45
74C901	3.00
74C902	2.50
74C903	2.50
74C904	2.50
74C905	15.00
74C906	2.90
74C907	2.90
74C908	2.75
74C910	14.00
74C911	12.50
74C912	12.50
74C914	4.50
74C915	4.00
74C917	15.50
74C918	2.90
74C920	12.50
74C921	12.50
74C922	7.50
74C923	7.90
74C925	8.90
74C926	8.90
74C927	9.90
74C928	9.00
74C929	9.50
74C930	2.75
74C932	2.50
74C941	2.50
74C989	8.90

74LS

74LS00	.60
74LS01	.60
74LS02	.60
74LS03	.60
74LS04	1.00
74LS05	1.00
74LS08	.60
74LS09	.80
74LS10	.80
74LS11	.80
74LS12	.80
74LS13	.90
74LS14	1.80
74LS15	.80
74LS19	.90
74LS20	.90
74LS21	.90
74LS22	.90
74LS24	.90
74LS26	.90
74LS27	.90
74LS28	.90
74LS30	.90
74LS32	.60
74LS33	.60
74LS37	.70
74LS38	.80
74LS40	.80
74LS42	1.90
74LS47	1.80
74LS48	1.80
74LS49	1.80
74LS51	.70
74LS54	.80
74LS55	.80
74LS63	2.80
74LS73	1.00
74LS74	2.50
74LS75	1.00
74LS76	1.00
74LS77	1.00
74LS78	1.10
74LS83	1.50
74LS85	1.75
74LS86	.80
74LS90	1.20
74LS91	1.20
74LS92	1.20
74LS93	1.50
74LS95	1.20
74LS96	1.20
74LS107	.90
74LS109	.90
74LS112	.70
74LS113	.70
74LS114	.80
74LS122	1.30
74LS123	1.30
74LS125	1.20
74LS126	1.20
74LS132	1.50
74LS133	4.90
74LS136	1.50
74LS138	1.50
74LS139	1.50
74LS145	2.10
74LS147	2.50
74LS148	1.90
74LS151	1.20
74LS152	1.95
74LS153	1.00
74LS154	2.95
74LS155	1.50
74LS156	1.50
74LS157	1.90
74LS158	1.00
74LS160	1.00
74LS161	1.00
74LS162	1.50
74LS163	1.10
74LS164	1.40
74LS165	1.00
74LS166	2.55
74LS170	2.45
74LS173	1.20
74LS174	1.20
74LS175	2.80
74LS181	4.00
74LS190	1.50
74LS191	1.20
74LS192	1.20
74LS193	1.20
74LS194	1.20
74LS195	1.75
74LS196	1.75
74LS197	1.75
74LS221	2.00
74LS240	2.40
74LS241	2.40
74LS242	2.40
74LS243	2.40
74LS244	2.50
74LS245	2.95
74LS247	1.30
74LS248	1.50
74LS249	1.60
74LS251	1.50
74LS253	1.20
74LS257	1.20
74LS258	1.20
74LS259	2.25
74LS261	2.50
74LS266	1.20
74LS273	1.95
74LS275	6.80
74LS279	1.00
74LS280	2.60
74LS283	1.50
74LS290	1.50
74LS293	1.30
74LS295	1.75
74LS297	16.50
74LS298	1.20
74LS299	3.90
74LS320	3.95
74LS321	3.95
74LS322	6.75
74LS323	6.50
74LS324	2.20
74LS326	2.20
74LS327	2.20
74LS352	2.20
74LS353	2.20
74LS354	3.95
74LS365	1.00
74LS366	1.00
74LS367	1.00
74LS368	1.00
74LS373	2.00
74LS374	2.00
74LS375	1.00
74LS377	2.15
74LS378	1.20
74LS379	1.90
74LS386	1.00
74LS390	1.80
74LS393	1.80
74LS395	2.00
74LS396	2.50
74LS398	3.00
74LS399	1.90
74LS424	5.50
74LS440	5.50
74LS441	5.50
74LS442	5.50
74LS443	550
74LS445	2.20
74LS446	5.50
74LS447	1.90
74LS448	5.50
74LS449	5.50
74LS490	3.20
74LS540	5.95
74LS541	7.95
74LS621	2.75
74LS622	2.75
74LS623	5.95
74LS629	5.95
74LS640	3.95
74LS641	2.75
74LS642	2.75
74LS643	2.75
74LS644	2.75
74LS645	2.75
74LS668	1.75
74LS669	1.75
74LS670	2.75
74LS673	12.55
74LS674	12.55
74LS690	3.95
74LS691	3.95
74LS692	3.95
74LS693	3.95
74LS696	3.95
74LS699	3.95

CDP

CDP1802	16.50
CDP1864	17.50

CPU

6502	13.00
6502A	14.00
6503	13.00
6504	13.00
6505	13.00
6507	13.00
6520	5.50
6521	5.90
6522	13.00
6522A	13.00
6532	14.00
6545	22.50
6551	12.90
2650	21.00
2651	23.00
6800	8.00
6802	10.00
6808	12.50
6809	17.00
6810	3.50
68B10	
6820	5.50
6821	5.50
68B21	
6840	6.50
6844	15.00
6845	25.00
6847	7.50
6850	3.50
68B50	
6860	10.00
6875	15.50
Z80CPU	7.00
Z80ACPU	8.00
Z80BCPU	16.00
Z80P10	4.50
Z80AP10	6.50
Z80CTC	6.50
Z80ACTC	8.50
Z80DMA	16.00
Z80ADMA	19.00
Z80AS10	15.00
Z80S10	13.00
AD570	69.50
AD590	9.50
AD7524	17.50
AY-3-8910	14.50
AY-3-2513	14.50
MSM5832	16.50
MM58174	19.50
MM5303	7.50
MM5309	14.50
MM5369	4.95
LH0002	9.50
LH0042CH	7.50
LH0070	7.50
LH0071	7.50
TL061	1.50
TL062	2.90
TL064	4.90
TL071	1.20
TL072	2.90
TL073	3.20
TL074	4.90
TL081	1.90
TL082	2.50
TL083	2.90
TL084	3.45
TL494	4.90
TCA220	9.50
TCA280	4.50
TDA1024	2.90
TA7205P	3.90
TEA1002	17.50
UAA170	5.95
UAA180	3.75
LM10CH	7.50
LM301	1.00
LM301H	1.50
LM302H	6.50
LM305H	1.50
LM307CN	1.00
LM307H	1.60
LM308	1.20
LM308H	1.80
LM309K	1.90
LM310N	3.20
LM310H	3.20
LM311	1.00
LM311H	1.80
LM317T	2.50
LM317K	4.50
LM318	3.50
LM318	3.50
LM324	1.50
LM325	4.50
LM326	4.50
LM329DZ	.90
LM344Z	1.70
LM335Z	2.20
LM336 2.5V	2.95
LM338K	12.50
LM339	1.20
LM348	1.80
LM349	1.60
LM350K	8.50
LM351N	1.00
LM353	2.50
LM356N	1.40
LM357	1.40
LM358	1.40
LM361	3.50
LM377	4.90
LM378	3.95
LM379-S	7.95
LM380 8PIN	1.80
LM380 14PIN	1.90
LM381	2.00
LM382	2.20
LM383	3.90
LM384	3.50
LM386	1.95
LM387A	LM3.95
LM387	2.00
LM390	2.95
LM391	2.90
LM393	1.00
LM394	4.95
LM395T	9.95
LM396K	22.50
LF398	5.90
NE544	6.50
NE555	.80
NE556	1.80
NE558	6.90
NE560	4.60
NE561	4.60
NE565	1.60
NE566	2.90
NE567	2.00
NE570	5.90
NE571	5.90
NE592	6.90
NE594	9.50
LM709-14	1.50
UA710CN	1.00
LM711	1.20
LM723	.75
LM723CH	1.50
LM725	4.75
LM733	1.50
UA739	2.75
741	.80
UA747	1.30
UA748	1.00
MC1310	9.50
MC1312	7.95
MC1314	7.95
MC1315	8.95
MC1327	7.95
MC1350	1.95
MC1408L8	7.50
MC1437	4.95
MC1445	5.95
MC1456	1.95
MC1458	1.20
MC1466L	14.50
MC1469R	6.90
MC1488	2.50
MC1489	2.50
MC1494	8.40
MC1495	8.90
MC1496	2.50
LM1596	3.00
MC1648	8.90
LM1812	10.50
LM1830	3.90
LM2907	3.50
LM2917 8PIN	3.40
LM2917 14PIN	3.40
MN3001	17.50
CA3028	2.00
CA3046	1.90
CA3056	6.50
CA3059	5.95
CA3080	1.90
CA3086	1.90
CA3089	3.90
CA3100E	7.95
CA3130E	2.20
CA3130T	2.95
CA3140E	2.20
CA3140T	2.95
CA3240E	11.95
LM3401	1.00
LM3900	1.20
LM3905	1.75
LM3909	2.95
LM3911	2.95
LM3914	5.90
LM3915	5.90
LM3916	5.90
LM3999Z	2.60
RL4136	1.95
RC4145	20.90
RC4194	3.90
MM 5369	4.95

SCR & TRIACS

SC141D	1.50
SC141E	1.95
SC142E	2.95
SC146D	2.85
SC146M	2.95
SC150D	4.95
SC151D	2.95
C103YY	.90
C103B	.90
C106B	.90
C106D	.90
C122D	2.50
C122E	2.95
C1260D	8.50
C1260E	9.90
2N2646	1.20
2N2647	2.50
2N6027	.90

TRANS.

AC125	1.20
AC126	1.20
AC127	1.20
AC128	1.20
AC187	1.50
AC188	1.50
AC149	3.40
AD161	2.90
AD162	2.90
AF118	2.90
AF126	2.90
AF127	1.50
BC 107	.50
BC 108	.50
BC 109	.50
BC 159	.50
BC 177	.60
BC 178	.60
BC 179	.60
BC 182L	
BC 212	.30
BC 318	.30
BC 320	.40
BC 327	.30
BC 328	.30
BC 337	
BC 338	.40
BC 546	.40
BC 547	.20
BC 548	.20
BC 549	.20
BC 550	.40
BC 556	.40
BC 557	.20
BC 558	.20
BC 559	.20
BC 635	.80
BC 636	.80
BC 637	.80
BC 638	.80
BC 639	.50
BC 640	.50
BC Y70	1.90
BC Y71	1.90
BD135	1.00
BD136	.90
BD137	.90
BD138	.90
BD139	.90
BD140	.90
BD201	.90
BD202	.90
BD232	.90
BD233	.90
BS235	.90
BD236	.90
BD237	.90
BD238	.90
BD262	1.20
BD263	1.20
BD437	1.50
BD488	1.50
BD647	1.80
BD648	1.80
BD677	1.80
BD681	2.00
BD682	2.00
BDV64B	5.50
BDV65B	5.50
BDX63	6.50
Y96 (BUX 80)	4.90
BDY97 (BUX 80)	4.90
BF115	1.50
BF167	1.20
BF173	1.20
BF177	1.20
BF180	1.20
BF182	.90
BF183	.60
BF184	.60
BF198	.60
BF199	.60
BF200	1.20
BF245	1.50
BF337	1.50
BF338	1.90
BF458	1.00
BF459	1.00
BF469	1.20
BF470	1.20
BF494	.90
BF495	90
BFW10	1.50
BFW11	1.50
BFW16	1.50
BFY50	1.20
BFY90	1.90
BFX90	1.50
BU126	2.50
BU208	3.90
BU326	3.00
BUX80	4.90
MFE131	2.90
MFE3001	9.90
MFE3003	6.95
MJ413	5.90
MJ802	7.50
MJ901	4.50
MJ1001	3.90
MJ11011	9.90
MJ11015	14.50
MJ11016	14.50
MJ15003	6.50
MJ15004	6.50
MJ15024	10.00
MJ2501	8.90
MJ2955	1.50
MJ3001	6.90
MJ4032	12.50
MJ4035	11.90
MJ4502	6.90
MJE340	2.00
MJE350	2.50
MJE371	2.90
MJE521	2.50
MJE700	3.50
MJE800	2.90
MJE2801	3.95
MJE2955	4.90
MJE3055	3.90
MJE13005	5.90
MJE13007	7.90
MJE13009	12.50
MPF121	2.50
MPF131	2.50
MPSA05	1.00
MPSA06	1.00
MPSA10	1.00
MPSA12	1.00
MPSA13	1.00
MPSA14	1.00
MPSA20	1.00
MPSA42	1.00
MPSA43	1.20
MPSA55	1.00
MPSA56	1.00
MPSA63	1.00
MPSA65	1.00
MPSA92	1.00
MPSA93	1.20
MPF102	.90
MPF103	.90
MPF105	.90
MPF106	.90
MPF109	.90
MPSL01	1.50
MPSL51	1.50
MPSU02	1.75
MPSU52	1.90
MPSU56	1.75
MPU131	1.75
MRF221	19.50
MRF237	3.90
MRF238	19.50
MRF245	43.50
MRF421	43.50
MRF454	34.00
MRF455	27.00
MRF455A	27.00
MRF475	4.70
MRF603	19.50
MRF641	32.00
MRF646	43.00
MRF901	2.75
MPF131	1.60
TIP31A	.90
TIP31B	1.00
TIP31C	1.20
TIP32A	.90
TIP32B	1.00
TIP32C	1.20
TIP41A	1.90
TIP41C	2.00
TIP42A	1.90
TIP42C	2.00
TIP49	1.90
TIP50	2.20
TIP53	2.50
TIP111	2.50
TIP112	2.50
TIP116	2.50
TIP117	2.50
TIP120	2.90
TIP122	3.45
TIP125	2.90
TIP127	3.40
145	3.40
TIP2955	1.90
TIP3055	1.90
2N301	4.00
2N697	1.00
2N918	1.00
2N1304	1.00
2N1613	1.20
2N2102	1.90
2N2219	.90
2N2222A	1.00
2N2369	1.00
2N2484	1.00
2N2646	1.20
2N2647	2.50
2N2894	1.00
2N2904	1.10
2N2905	1.10
2N2906	1.10
2N2907	1.10
2N3019	1.90
2N3053	.90
2N3054	1.90
2N3055	1.20
2N3096	1.20
2N3109	1.90
2N3251	1.90
2N3302	1.90
2N3440	1.80
2N3441	2.90
2N3442	3.50
2N3563	.30
2N3564	.30
2N3565	.30
2N3566	.30
2N3567	.30
2N3568	.30
2N3569	.30
2N3638	.30
2N3640	.30
2N3641	.30
2N3642	.30
2N3643	.30
2N3644	.30
2N3645	.30
2N3646	.30
2N3702	1.20
2N3704	1.40
2N3739	4.50
2N3771	5.50
2N3772	5.70
2N3773	5.90
2N3792	6.00

Errors & omissions excepted.

ROD IRVING ELECTRONICS

425 High St., Northcote, Vic. 48-50 A'Beckett St., Melb., Vic.
Phone (03) 489 8866, (03) 489 8131, Mail Order Hotline (03) 481 1436
Mail orders to P.O. Box 235 Northcote 3070 Vic. Minimum P & P $3.00.
Please address tax exempt, school, wholesale, and dealer enquiries to:
RITRONICS WHOLESALE
1st floor 425 High St. Northcote 3070 (03) 489 7099 (03) 481 1923 Telex AA 38897

MOTOROLA'S MOS MODEMS

Motorola has announced a set of MOS ICs for 300 and 1200 baud modem applications to suit Bell 103/113 (300) and Bell 202 as well as CCITT V.21 (300) and CCITT V.23 (1200) communications standards

The MC145445 comes in a 22-pin package and is TTL compatible. When paired with the MC145440 filter, it makes up a 300 baud Bell 103 modem or, when paired with the MC145441 filter it provides a CCITT V.21 modem.

These devices, using differential delay demodulation, provide high performance, low cost modems with the lowest bit error rate of 300 baud IC modem solutions, Motorola claim.

The MC145445 features eight selectable RTS/CTS delay options, answer-back tone generator and a carrier detect input.

The MC145450 is a 1200 baud modem intended for use in Bell 202 and CCITT V.23 standard applications.

It is TTL compatible and can be pin-programmed for either Bell or CCITT operation. The 22-pin DIL package derives internal timing from a standard 3.6864 MHz crystal.

For CCITT V.23 applications, the chip is Mode 2 compatible with a baud rate of up to 1200 bits/sec on the main channel and up to 75 bits/sec on the backward channel.

A logic-controlled mode input selects the frequency pair used for modulation and demodulation, as well as the transmit and receive baud rates. The CTS signal can be delayed in eight steps over a 0-426.6 ms range under logic control. Additional functions include logic-controlled self-test, transmit test, answer-back and soft turn-off.

We have no information of delivery schedules or prices as yet. Motorola distributors in Australia are VSI and Soanar.

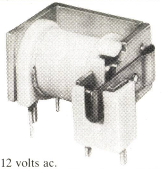
PC MOUNT RELAY SWITCHES 30 AMPS

Inexpensive printed circuit board mount relays for ac or dc loads up to 30 amps are now avaialble from Potter & Brumfield, through their Australian Distributor, Tecnico Electronics.

T90 series relays are designed for use in appliances and heating, ventilating and air-conditioning equipment. Additional applications are anticipated in load management, automotive and other markets where logic systems need to be interfaced with high current loads.

Measuring only about 24 x 30 x 17 mm high, open-style T90 series relays feature printed circuit terminals arranged on a 0.05" x 0.1" (1.3 x 2.5 mm) grid. Snap-on plastic dust covers are available as an option.

Silver or silver-cadmium oxide contacts are offered in 1 form A (SPST-N/O), 1 form B (SPST-N/C) and 1 form C (SPST) arrangements. Maximum contact rating is 30 amps, inductive or resistive, at 240 volts ac. T90 relays will also switch loads as low as 0.5 amps at 5 volts dc or 12 volts ac.



T90 series relays are available with dc coils for 5, 6, 9, 12, 18 or 24 volts. Coil resistance ranges from 18 Ohms for 5 volt models to 456 Ohms for 24 volt models. Nominal coil power is 1.25 watts. Class B (130°C) insulation is standard.

Initial breakdown voltage exceeds 1500 volts rms from contact to contact and from contact to coil. T90 relays are designed to operate in ambient temperatures from −55°C to +85°C.

For additional information, contact, **Tecnico Electronics, 67 Mars Road, Lane Cove, NSW 2066. (02)427-3444.**

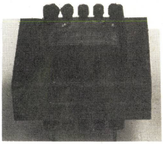
FIVE-LEGGED DRIVERS

Two new universal, high current drivers are now available from RIFA. They are intended for resistive loads, solenoids, relays and low-power lamps.

The PBD3544 and PBD3545 are complementary drivers (source/sink versions). They have a continuous output capability of 2 A at 45 V. Both feature an error detection function which is claimed to enhance serviceability by allowing their incorporation into diagnostic circuitry in the host product.

The PBD 3544/45s contain extensive protection circuitry which renders them virtually indestructible when driving a wide variety of loads. Important operational characteristics include short-circuit protection, thermal overload protection, internal protection diodes, open circuit detection. The inputs are LS-TTL and CMOS compatible. Encapsulation is a 5-pin TO-220.

Details from **RIFA Pty Ltd, PO Box 95, Preston Vic 3072. (03) 480-1211.**



NEW ISOLATION TRANSFORMERS FOR MODEMS

The ever increasing use of microcomputers has created a demand for modem interfacing to link computers via telephone or radio.

To meet this need, Ferguson Transformers has added two new Telecom-approved line isolation transformers to their range. Both are intended for printed circuit board mounting and are capable of handling most data transmission requirements.

Designated MT-620 and MT-627, both have a matching impedence of 600 Ohms. The MT-620 provides a flat response between 300 Hz and 2200 Hz with rapid attenuation to 20 kHz. As a result, crosstalk and noise outside the required bandwidth are greatly reduced.

Where a flat response is required across the whole bandwidth, the MT-627 covers the entire range from 300 Hz to 20 kHz.

Other applications include radio to telephone patching and centralised word processing.

The two new transformers join a range of printed circuit board mounted power transformers of similar design with secondary ratings from 9 to 30 V and 2.5 to 12 VA.

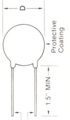
The MT-620 and MT-627 are wholly designed and manufactured in Australia to suit Australian conditions and are available from stock. Further information is available from **Ferguson Transformers Pty Ltd, 331 High Street, Chatswood 2067 NSW. (02)407-0261.**

SURGE-GARD™

INRUSH CURRENT LIMITING DEVICES

AMETEK
RODAN DIVISION

Rodan **Surge-gard** devices are made from a specially formulated metal oxide ceramic material which is capable of suppressing high inrush current surges. They are especially useful in power supplies where, due to the extremely low impedance of the filter capacitors the rectifiers can be subjected to an excessively high current surge at turn on. The **Surge-gard**, being of relatively high resistance limits the current for 1-2 seconds during which time the device decreases in resistance substantially to a point where the voltage drop is negligible.
If the resistance of one **Surge-gard** does not provide sufficient inrush current limiting in your application, two or more may be used in series or in separate legs of the supply circuit. **Surge-gards** cannot be used in parallel since one unit will tend to conduct nearly all of the current available. **Surge-gards** may be used in either **AC** or **DC** circuits and are available with maximum steady state **DC (AC RMS)** current ratings to **20 AMPS** at ambient temperatures of up to **65C.**



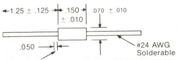
Specifications

Part Number	Resistance (OHMS)	I_{max} Max Steady State Current (AMPS)	$R_{I_{max}}$ Resistance At Max Current (OHMS)	"D" (Diameter max over coating)	"T" (Thickness max over coating)	"L" Lead Diameter ±.003"
SG100	1	20	.015	.900	.300	.040
SG110	2	18	.03	.900	.350	.040
SG120	2.5	3	.15	.600	.250	.032
SG130	2.5	7	.05	.600	.250	.032
SG140	2.5	9	.04	.600	.250	.032
SG150	2.5	10	.04	.900	.250	.040
SG160	2.5	15	.03	.900	.300	.040
SG170	4	8	.07	.600	.250	.040
SG180	5	2	.40	.600	.250	.032
SG190	5	4	.15	.600	.250	.032
SG200	5	7	.07	.600	.250	.032
SG210	7	4	.15	.600	.300	.040
SG220	10	3	.20	.45	.300	.032
SG230	20	1.75	.6	.500	.250	.032
SG240	40	2	.6	.625	.250	.032
SG250	120	3	.9	.925	.250	.040

MINI-SENSOR™

HERMETICALLY SEALED • GLASS ENCAPSULATED

NTC AND PTC THERMISTORS



NOTE: Lead diameter uncontrolled within this area, typical.

AMETEK
RODAN DIVISION

Description:
Rodan® Mini Sensor thermistors are small, rugged, hermetically sealed, glass encapsulated (DO-35) devices which are especially useful in applications where extreme temperatures and severe environmental conditions are encountered. They can be supplied with Negative Temperature Coefficient characteristics and are available in a broad range of resistance values.
Their high sensitivity makes them especially useful in applications such as temperature measurement, temperature control, liquid level indication, flow measurement and temperature compensation.
These low cost devices exhibit excellent long term stability and repeatability.

SPECIFICATIONS: NTC

Part Number	Resistance @25°C OHMS ±10%	Temp. Coeff. %/°C @25°C	Resistance Ratio $\frac{R25°C}{R125°C}$	Resistance Temp. Characteristics (See Table)
MSB202K	2,000	-3.9	19.7	B
MSB502K	5,000	-3.9	19.7	B
MSB103K	10,000	3.9	19.7	B
MSB153K	15,000	-3.9	19.7	B
MSC203K	20,000	4.4	29.25	C
MSC253K	25,000	4.4	29.25	C
MSC503K	50,000	4.4	29.25	C
MSC753K	75,000	4.4	29.25	C
MSC104K	100,000	4.4	29.25	C
MSC154K	150,000	4.4	29.25	C

Please send for free Data sheets on **Surge-gards &**
Thermistors Steweart Electronic Components Pty. Ltd.
44 Stafford St. Huntingdale 3166. Phone 543 3733 Telex 36908
437 City Rd. Sth. Melbourne Phone 690 8333

SOANAR NOW MARKETING NEC SEMICONDUCTORS

Soanar Electronics has been appointed as the distributor for the Semiconductor Division of NEC Australia Ltd.

NEC Electron Devices, the Semiconductor Division of the giant NEC Corporation of Japan offers a very competitive source for INTEL integrated circuits.

Backed by the resources of NEC, Soanar will now be stocking the following range at all Soanar Branches throughout Australia: RAMs, EPROMs, single chip 8-bit microcomputers, microprocessors and peripheral ICs.

In addition, Soanar will handle the NEC range of CMOS 4-bit microprocessors which they claim are ideally suited to the Australian market.

A new 1984 microcompute catalogue is currently being printed and is due for release shortly. For further information contact **Soanar Electronics Pty Ltd, P.O. Box 170, Box Hill Vic (03)890-0661.**

HCMOS DATA BOOK

Motorola's reference book on the MC54/74HC high-speed CMOS logic family is now available.

The book offers a complete function selector guide, a military/hi-rel selector guide, a design considerations chapter and data sheets. A total of 147 devices are detailed, with 71 circuit descriptions including ac/dc parametrics and 76 parts with pinout and functional descriptions only.

In the extensive function selector guide, the devices are grouped into 15 categories of logic functions. To assist users in choosing a device, the features are described in a vertical column and the devices are listed horizontally. The guide also includes block diagrams for al 147 devices.

The design consideration chapter provides information on power supply considerations and handling precautions.

The ac and dc parametrics ar specified for a range of two t six volts and temperatures up t 125°C. The chapter on reliabilit includes major test description and tabulations of results.

Copies of the High Speed Data Book can be obtained from **Motorola Semiconducto Products, 250 Pacific Hwy Crows Nest NSW 2065. (02)438 1955.**

SURGE PROTECTION AND TESTING BOOKLET

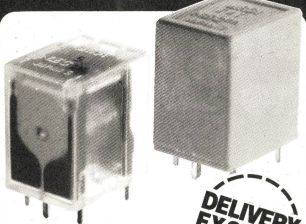
A 20-page, fully illustrated booklet published by Key-Tek Instrument Corp is an introductory guide to surge protection and testing of systems, circuits and protective devices. The material is keyed to both technical and non-technical personnel.

A question-and-answer format covers the causes of transient spike voltage and current surges, and the problems they create in today's computers an other microelectronic systems.

The booklet outlines circu design and test techniques fo surge protection, and discusse the new IEEE Standard 587 fo ac power-line spike surges.

Copies are free of charge t electronics engineers engaged i equipment design or testing, an can be obtained from **The Dir dima Group Pty Ltd, PO Bo 106, Vermont Vic. 3133.**

NEC
RELAYS



DELIVERY EX STOCK

MR 31 Series

MR31 Sub-miniature Relay is an extremely small and lightweight "1 Form C Relay" which, in addition to being highly suitable for printed-circuit boards, will also greatly reduce the dimensions and weight of various types of equipment.

FEATURES

- ● Because its small size and weight, the MR31 requires the smallest possible mounting space and can be soldered directly onto printed-circuit boards.
- ● Wide Contact Rating Range
- ○ Low power type uses a high reliability contact made of silver nickel and alloy with gold plating, and offers a switching range from 1 mA to 1 A.
- ○ General type, which has high reliability silver nickel alloy contact ensures a wide switching range from 0.1 A to 5 A.
- ○ High power type with wear-proof silver oxide alloy contacts permits high power switching from 1A to 10 A.
- ● Completely Sealed and Flux Tight
- ○ Being sealed tightly to prevent entry of flux and flushing solvent, the MR31 relay can be wave soldered.

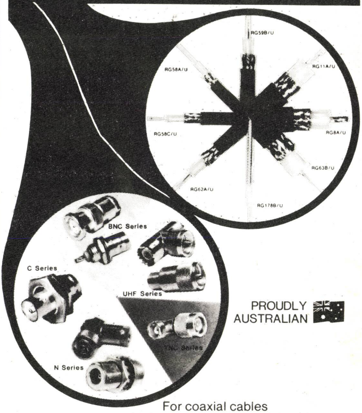
TECHNICAL INFORMATION AVAILABLE ON REQUEST.

soanar

SOANAR ELECTRONICS PTY. LTD.
INCORPORATED IN VICTORIA
30-32 Lexton Road, Box Hill, Vic., 3128, Australia.

VICTORIA: 895 0222 **QUEENSLAND: 52 1131**
N.S.W.: 789 6744 **WEST. AUST.: 381 9522**
STH. AUST.: 42 8918 **TASMANIA: 31 6533**

Coaxial Cables and Connectors



PROUDLY AUSTRALIAN

For coaxial cables and connectors the **only** name to remember is ACME! Whether you need imported Mil-Spec coaxial connectors or cable, ACME will supply. In fact, ACME manufacture, right here in Australia, a wide range of popular connectors. Ask for literature by contacting the ACME office near you.

ACME **ACME ELECTRONICS**
A Division of James Hardie Electrical (Hardie Trading Ltd. Inc. in Vic.)

VIC. 2-18 Canterbury Rd, Kilsyth 3137. Tel: 729 6211
N.S.W. 120 Beaconsfield St, Auburn 2144. Tel: 648 2255
QLD. 358 2011 (Brisbane)
71 4131 (Townsville)
51 4422 (Cairns)
38 5933 (Surfers Par)
A.C.T. 80 4654
S.A 272 8011
W.A. 272 7122
TAS. 34 2811 (Hobart)
31 5545 (Launceston)

Precision temperature measurement and control using the LM335

Brian Dance

Measuring temperature for its own sake or in a control application requires a suitable 'transducer' to provide an accurately known relationship between temperature and output. That's just what the LM335 does.

THERE ARE MANY ways of measuring temperature, but the familiar mercury-in-glass thermometer does have the disadvantage that it is not easily read and remote readout is impossible. The circular clock-face type of thermometers based on bimetallic strip in the form of a coil are very convenient for hanging on the wall in the home or greenhouse, but have a very limited accuracy. Electronic thermometers providing a very accurate digital indication of temperature are very convenient, although the commercially available types are necessarily moderately expensive.

This article describes the use of a device specially developed by National Semiconductor for the precision measurement of temperature which can be used in circuits whose output is usually fed to a digital voltmeter so that a digital indication of temperature can be obtained.

The LM335

The LM335 is an integrated circuit temperature sensor for use over the range 0° C to +100° C. It is available in economical plastic packaging with the connections shown in Figure 1, although a similar device is available in a TO-46 metal transistor type package with the connections of Figure 2.

The LM335 is a relatively economical device, but the LM235 is a similar product with the same internal circuitry designed for use over the −25° C to +100° C range and the LM135 can operate over the military temperature range of −53° C to +150° C; these last two devices have narrower tolerance than the LM335 specifications. Suffix 'A' versions, such as the LM335A, are also manufactured with more closely specified characteristics. However, it will be assumed that readers will employ the most economical device in the range, the LM335, although the circuits can be used with any of the devices named.

Basically, the LM335 is operated in the same way as a zener diode, as shown in the circuit of Figure 3. The breakdown voltage (that is, the output voltage from this circuit) is directly proportional to the absolute temperature and is 10 mV/K over the specified working temperature range.

The value of R1 in Figure 3 determines the current flowing through the device, but as the dynamic impedance at 1 mA is typically 0.6 Ohm, the device can be operated over the current range of 400 μA to 5 mA with virtually no change in its performance. It should be noted that the absolute maximum forward or reverse current which may safely be passed through the device (even momentarily) is only 10 mA; higher currents may cause irreversible damage to the LM335.

At 25° C and a reverse current of 1 mA, the operating output voltage from the Figure 3 circuit is typically 2.98 V with minimum and maximum limits of 2.92 V and 3.04 V. The value chosen for R1 may be calculated for a current through the LM335 of 1 mA using the equation R1 = $(V+ - V_{out})/0.001$ which equals approximately (V+ - 3) kilohm.

Linear output

A particular advantage of the LM335 i the linear output provided by its circuit unlike the output of most other temperature sensors which is not linearly relate to temperature. Indeed, if the output voltage is plotted against temperature over th working range and the graph is extrapolated back to the absolute zero of temperature, the output read from the grap at the latter temperature will be zero.

Although the LM335 output from th Figure 3 circuit is within the limits stated calibration connection is included on th chip. It is only necessary to connect potentiometer across the LM335, as show in Figure 4, and adjust this potentiomete to 2.982 V output when the device is a 25° C in order to obtain higher accurac over the whole temperature range.

The single calibration temperature ove the whole working range is possible because the output is accurately proportiona to the absolute temperature with the extrapolated output falling to 0 V at the absolute zero of temperature. Variation from one LM335 to another are only i the slope of the voltage/temperatur graph, so a slope calibration at one temperature corrects for all others. Thus, calibration is far easier than with a non-linea device such as a thermocouple.

Self heating

As with any temperature sensing system any heat generated by the current passin through the sensing device will affect it temperature and hence the output voltage The LM335 should therefore be operate at the lowest current which is adequate t drive its internal circuitry. When calculating the value of R1 allowance should b

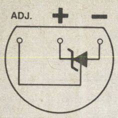


Figure 1. The TO-92 plastic encapsulated LM335.

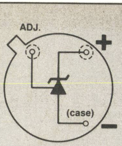
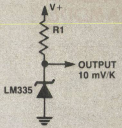


Figure 2. The TO-48 metal encapsulated LM335.

Figure 3. The basic LM332 circuit.



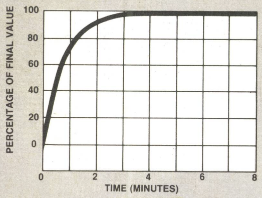


Figure 5. Response time of the LM335 to a temperature change in free air.

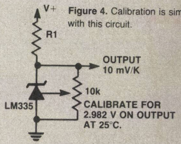


Figure 4. Calibration is simple with this circuit.

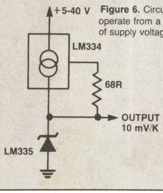
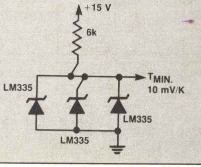


Figure 6. Circuit able to operate from a wide range of supply voltages.

Figure 7. This circuit records the minimum temperature of any of the devices.



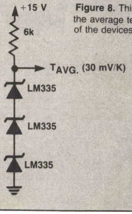


Figure 8. This circuit records the average temperature of the devices.

nade for the current passing through any alibrating potentiometer in parallel with he device and for any output current. A urrent of about 400 μA is about the noral minimum.

If the sensor is used in a situation where he thermal resistance to the surroundings s constant, self-heating errors can be calirated out, provided the device is operted with a constant current independent f temperature. Heating of the device will hen be proportional to the zener voltage nd to the absolute temperature; thus, the elf-heating error is proportional to the bsolute temperature and temperature cale linearity is preserved.

Performance

n a typical LM335 circuit which has not een calibrated, operating at 1 mA, the emperature error is 2° C (maximum 6° C) t 25° C or 4° C (maximum 9° C) over the vhole working range. When calibrated the ypical error at the temperature limits is °C. Non-linearity at 1 mA is typically .3° C over the range.

In still air the device requires about three minutes to reach its final temperature after a temperature change has occurred (Figure 5), the time constant being typically 80 seconds. In stirred oil the final temperature is reached within about three seconds (time constant typically one second). The device is stable to 0.2° C (typical) over 1000 hours, even at 125° C.

The dynamic impedance is less than one Ohm at frequencies up to more than 1 kHz (typical), but increases to 20 to 30 Ohms at 100 kHz.

Circuits

The circuits of Figures 3 and 4 are suitable for use when the supply voltage is reasonably constant. If wide variations in the supply voltage are expected to occur, the LM334 constant current device may be used with the external resistor to set the LM335 current at about 1 mA for all supply voltages. (Figure 6.)

If a number of LM335 ICs are connected in parallel, as in Figure 7, the output will correspond to that of the device which is at the minimum temperature. Thus a minimum indication of the temperatures at three locations is easily obtained.

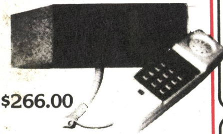
Similarly, a number LM335 devices may be connected in series, as in Figure 8, in which case the output will represent the average temperature of the devices, but will be increased by a factor equal to the number of devices used.

Centigrade Thermometer

The circuits discussed previously are basic ones which provide an output voltage directly proportional to the absolute temperature, but this is not very consistent for feeding to a digital voltmeter to produce a reading directly in ° C. The additional operational amplifier circuit of Figure 9 is required for this purpose.

In this circuit the LM336 provides a precise 5 V reference voltage to pin 3 of the LM308 operational amplifier. The negative feedback to pin 2 is adjusted by means of the 2k potentiometer so that the output of the amplifier is at a potential of 2.73 V. The voltage difference between this output and that from the LM335 circuit is then a measure of the Centigrade ▶

SHUTTLE 300T DATA MODEM



$266.00

GENERAL DESCRIPTION

The Shuttle 300 is a direct connect modem, providing full duplex operation, up to 300 Baud, via the RS-232 Port of a Terminal or Personal Computer.

The Shuttle 300 is a basic modem, relying on a telephone for dialling and answering calls. However it does provide the full 12V bipolar output signals required by RS-232C for reliable operation with computers and terminals. The RS-232 connector also provides "Carrier detect" and "clear to send" outputs and uses "Data Terminal ready" and "request to send". Three front panel led's provide visible indication of carrier detect, receive data and transmit data status, while a fourth led is used as a power on indicator.

The "Voice/Data" switch allows selection of telephone or modem operation. An "Answering/Origin" switch allows either answer or originate mode of operation.

Power for the Shuttle 300 is provided by an internal power supply which conforms to Telecom Australia regulations.

SOLDER BLOTTER

- 2 metres x 3 mm
- 30% Longer than most.

Avoid Fingers— Metal Tipped Dispenser.

$2.07

SOLDER	250 GM REELS	
0.71 mm	60/40	$5.91
1.25 mm	60/40	$4.95

500 GRAM REELS

0.71 mm	60/40	$12.80
1.25 mm	60/40	$10.80
1.60 mm	60/40	$10.80

2.6 KG: REELS

1.25 mm	60/40	$54.00

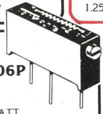
ARLEC 200H Mk 2 MULTIPURPO METER

for electrical testing.

Measures Voltage, Current and Resistance.

- SEC Approved
- 12 months Guarantee

BOURNS MODEL 3006P CERMET TRIMPOTS



15 TURN 1.25 WATT
ALL POPULAR VALUES

200 ohms	500 ohms
1K	2K
5K	10K
20K	50K
100K	200K
500K	1 MEG

$1.27 ea.

ARLEC PS499 PLUG PACK BATTERY ELIMINATOR 6 VOLTAGE

Suitable for 3V 4.5V 6V 7.5V 9V 12V equipment to 300mA

- Flash Guns
- Electric Models
- Toys etc
- 12 months guarantee
- Cassette Recorders
- Calculators

$9.61

Eliminates batteries by running equipment direct from the mains electricity supply. SEC approved

MULTIMETERS

BECKMAN 3030	$346
BECKMAN HD100	$290
SANWA N501	$157
SANWA N301	$109
SANWA 460ED	$110
SANWA EM300	$105
SANWA CX50511	$81.
SANWA LD510	$144
SANWA AX303	$66.
SANWA LD530F	$26
SANWA BX808M	$92.
SANWA CP-7D	$36.
SANWA U-60D	$43.
SANWA LD520H	$24
SANWA BX505	$69.
SANWA ZX505	$10
SANWA CP7D CASES	$4.6
SANWA TB-Z CASES	$5.7
SANWA CX505 CASES	$17
UNIVERSITY MVA50	$46
UNIVOLT DT1314	$41
UNIVOLT DT840	$65
UNIVOLT DT830	$11
UNIVOLT DT860	$12
KAISE SK244	$27
K.W TS2000	$15
ARLEC 200H MULTIMETER	$18

Model 1260 MICROCOMPUTER SYSTEM DESK

For the first time, a microcomputer system desk with all the features you would look for is available at a HOME COMPUTERIST TYPE PRICE!

$174.69

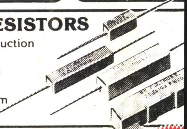
HIGH QUALITY, LOW COST, DO-IT-YOURSELF BOOKSHELF SPEAKER SYSTEM

AUDAX

The Compact 200 as featured in EA Sept 82

Speakers, Electronics Kit **$199**
Cabinets (per pair) **$99.50**

POWER W/W RESISTORS



Fireproof, inorganic construction
Easy to install

PW5 0.1 ohm to 4.7K ohm
37c. ea.
PW10 1.0 ohm to 5.6K ohm
50c. ea.

NIBBLING TOOL

CUTS holes any shape any size over
TRIMS undersized holes to fit parts
NOTCHES clearance for plugs and wiring

ALL PRICES INCLUDE SALES TAX

VIDEO TAPE SPECIALS

TDK 3 HOUR VHS	$15.45
TDK 3 HOUR BETA	$15.45

SUPER BARGAINS AT MAGRATHS

BRING A DISCO TO YOUR HOME

A ME $32.7

ARLEC PC410 DISCO LITE

FEATURES

- Plugs directly into 240V power socket — needs no wiring.
- 3 Position switch selects:
  1. Music colour with variable sensitivity.
  2. Strobe effects with variable speed.
  3. Light dimmer with variable intensity.
- Continuously variable control provides complete flexibility in all modes of operation.
- Can be used with 240V filament lamps to the total of 500 watts.
- Double insulated.
- S.E.C. approved and fully guaranteed.

3 IN 1 L
CONT

1 FLASHES LIG
TO THE BEAT OF M
2 STROBES AT DIFFER
SPE
3 DIMS THE LIGHTS
DANCING, MOODS AND EFF

Brings the Disco to your hon

SEAL OF SATISFACTION
MAGRATHS
WORLD OF ELECTRONICS

MAGRATHS ELECTRONICS Phone or Mail.
55 A'BECKETT STREET, MELBOURNE, 3000
Tele (03) 347 1122, Telex AA31001
Prices subject to change without notice.

bankcard welcome here

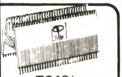
ALL ITEMS EX-STOCK AT THE TIME OF ADVERTISING

INSTRUMENT CASE. MODEL IC-1

KIT COMPRISING
- 2 blank styrene panels **$6.04**
- 4 bump on rubber feet
- all screws required for PCB mounting

CAMBION I/C SOLDER SOCKETS

8 PIN	21¢
14 PIN	29¢
16 PIN	33¢
24 PIN	47¢
28 PIN	58¢
40 PIN	76¢



TC48/ TC64-IC TEST CLIPS

14 PIN	$7.00
16 PIN	$7.34
16 PIN LSI	$13.80
18 PIN	$15.43
20 PIN	$17.68
22 PIN	$19.65
24 PIN	$20.33
28 PIN	$22.44
40 PIN	$29.85
64 PIN	$43.52

SOFTWARE SPECIALISTS FOR THE 68XX SERIES

MICROWARE SYSTEM CORP
OS-9 Level 1 Operating System
Basic 09 Programming Language
Macro Text Editor
Assembler
Debugger

TECHNICAL SYSTEMS CONSULTANTS
General Purpose Flex 6809
SWTPC Flex 6809
Extended Baic
Utilities
Pascal for Flex
68000 Cross Assembler for Flex
Soft Merge Package
Text Editor
Assembler
Debug Package
Diagnostics
Text Processor

DUGGERS GROWING SYSTEMS
6809 C Compiler ver 2:0

SWTPC
EDIT Word Processing Editor Flex

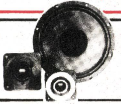
FRANK HOGG LABORATORY, INC
XForth
Basic Programmer Tool Kit
Password Protection Pack
Dynasoft Pascal Flex
Spell Test
Super Sleuth
Stylograph 2:0 Flex. OS-9
Dynastar Full Screen
Editor OS-9. Flex
CRASMB Cross Assembler. Flex. 6809. 6800. Z80. 8080. 6502
Tabula Rasa
Job Control Program
TRS80C Colour Flex

WASHINGTON COMPUTER SERVICES
6809RMS DBM for Flex

TALBOT MICROSYSTEMS
tForth
tForth +

COMPUTER SYSTEM CENTRE
DYNAMITE Dissassembler
DYNACALC

Check Our Super Special Prices This Month!



PHILIPS HI FI SPEAKERS

AD 12250/W8	12" 100W RMS	$106.61
AD 02160/SQ8	2" Dome Squaker	$ 40.78
AD 01610/T8	1" Dome Tweeter	$ 14.64
ADF 500/4500/8	40 Watt RMS Crossover	$ 28.41

ARLEC HI SPEED SUPER TOOL ET571

A VERSATILE ELECTRIC TOOL DESIGNED FOR:
• SANDING • GRINDING • POLISHING • CUTTING • ENGRAVING • DRILLING • MILLING • ERASING, ETC.

FEATURES: • OPERATES ON SAFE, LOW 12 VOLTS • RUNS ON MAINS ELECTRICITY VIA AC ADAPTOR SUPPLIED • LIGHT AND EASY TO HANDLE • TOUCH SWITCH ALSO HAS LOCK FOR CONTINUOUS RUNNING • HIGH TORQUE MOTOR • SPINDLE SPEED 10,000 RPM • CAN DRILL 2MM HOLES IN STEEL

DESIGNED IN AUSTRALIA

$30.50

CONTAINS

12 Volt Supertool
Plugpack AC adaptor
1 spherical Milling Cutter
1 Conical Milling Cutter
1 Wire Brush
1 Grinding Wheel
4 Drill Bits. 0.6, 0.8, 1.0, 1.2mm.
Set of 5 Chuck Collets.
6 Eraser Sticks

ANTI-STATIC FOAM

IDEAL FOR STORING I.C.'s

Sheet Size: 3 ft. x 2 ft. x ¼"—

$44.01 PER SHEET

MAGRATHS SUPER SPECIALS

SEMICONDUCTORS

0 Series

4001	.35
4002	.35
4006	.93
4007	.40
4009	.69
4010	.62
4011	.33
4012	.44
4013	.48
4014	1.15
4015	.96
4016	.51
4017	.96
4018	1.01
4019	.60
4020	.84
4021	1.51
4022	.96
4023	.36
4024	.71
4025	.36
4027	.60
4028	.96
2049	1.05
4030	.59
4035	1.20
4040	.90
4042	.83
4044	.71
4046	1.20
4047	1.05
4049	.53
4050	.53
4051	1.09
4052	1.38
4053	1.16
4056	1.13
4060	1.93
4066	.58
4068	.40
4069	.36
4070	.36
4071	.38
4076	1.62
4078	.40
4081	.55
4093	.56
4511	1.05
4514	2.60
4516	1.10
4518	.96
4520	.96
4528	1.27
4543	1.63
4702	10.29
4723	1.74
4724	2.23
4556	1.84

74C Series

74C00	.39
74C02	.39
74C08	.39
74C10	.39
74C14	.92
74C20	.39
74C30	.39
74C32	.39
74C48	2.30
74C73	.98
74C74	1.15
74C89	1.73
74C90	1.35
74C93	1.50
74C157	2.93
74C174	1.44
74C175	1.44
74C192	1.82
74C909	2.65
74C914	2.24
74C915	1.63
74C925	6.90
74C926	6.90

7400 Series

7400	.46
7401	.46
7402	.46
7403	.46
7404	.46
7405	.46
7406	.52
7407	.46
7408	.46
7410	.46
7411	.46
7413	.46
7414	.46
7417	.46
7420	.46
7426	.46
7430	.46
7432	.46
7440	.46
7441	1.07
7442	.46
7445	.98
7446	.98
7447	.75
7448	1.44
7460	.46
7473	.46
7474	.46
7475	.69
7476	.45
7485	.69
7486	.46
7490	.58
7492	.63
7493	.58
7494	1.75
7495	.58
7496	.81
74107	.61
74109	.43
74121	.53
74123	.66
74125	.52
74145	1.25
74151	.58
74154	1.73
74164	.69
74165	.81
74174	.58
74175	.58
74191	1.14
74192	.58
74193	.96
74196	1.84
74365	.81
74367	.81

74LS Series

74LS00	.44
74LS01	.44
74LS02	.44
74LS03	.44
74LS04	.44
74LS05	.44
74LS08	.44
74LS09	.44
74LS10	.44
74LS11	.44
74LS12	.44
74LS13	.44
74LS14	.44
74LS15	.44
74LS20	.44
74LS21	.44
74LS22	.44
74LS26	.44
74LS27	.44
74LS30	.44
74LS32	.44
74LS37	.44
74LS38	.44
74LS40	.44
74LS42	.58
74LS47	.67
74LS48	.71
74LS49	1.38
74LS51	.44
74LS54	.44
74LS55	.44
74LS73	.44
74LS74	.44
74LS75	.52
74LS76	.52
74LS78	.58
74LS83	.71
74LS85	.52
74LS86	.44
74LS90	.60
74LS92	.60
74LS93	.69
74LS107	.58
74LS109	.52
74LS112	.46
74LS113	.52
74LS122	.69
74LS123	.81
74LS125	.58
74LS126	.63
74LS132	.58
74LS136	.76
74LS138	.81
74LS139	.81
74LS151	.58
74LS153	.52
74LS154	2.48
74LS155	.69
74LS157	.69
74LS158	.69
74LS160	2.30
74LS161	.81
74LS162	.81
74LS163	.81
74LS164	.81
74LS165	1.38
74LS168	1.63
74LS169	1.63
74LS170	1.04
74LS173	.75
74LS174	.69
74LS175	.69
74LS189	6.13
74LS190	1.04
74LS191	1.04
74LS192	.75
74LS193	1.04
74LS194	.81
74LS195	.81
74LS196	.81
74LS197	1.15
74LS221	.81
74LS240	.92
74LS241	1.15
74LS242	.86
74LS243	.86
74LS244	1.38
74LS245	1.61
74LS247	.83
74LS248	1.77
74LS249	1.38
74LS251	.75
74LS257	.58
74LS258	.58
74LS266	.52
74LS279	.52
74LS283	.69
74LS290	.58
74LS293	.58
74LS365	.58
74LS366	.81
74LS367	.58
74LS368	.58
74LS373	1.15
74LS374	1.15
74LS386	.94
74LS393	.92
74LS541	1.04
74LS629	2.46
74LS640	2.47
74LS670	1.32

Micro

6508	7.76
6800	5.75
6810	5.40
6821	2.88
68A21	4.03
6834	15.30
6852	6.30
6850	5.96
68B50	11.50
6854	16.10
2516	4.27
2532	8.05
2564	13.80
2732	6.33
2764	9.38
27128	44.85
4116	2.30
4164	7.76
8114	4.60
8116	3.97
8118	4.54

74F Series

74F00	.60
74F02	.60
74F04	.60
74F08	.60
74F10	.48
74F32	.54
74F109	.92
74F164	1.67
74F194	2.13
74F245	5.41
74F374	3.51

Misc.

95H90	10.06
76489	7.73
76488	4.23
76477	4.23
TMS4500	26.45
TMS9929	38.13
11C90	14.66
AD570JD	49.11
AD590JH	5.87

FIGARO GAS SENSORS

812 # 813 $13.46 ea.

TGS APPLICATIONS

Combustible Gas-Leak Alarm
Carbon Monoxide Detector
Automatic Fan Control
Fire Alarm (Detecting combustible gases contained in smoke)
Air Pollution Monitor

TGS FEATURES

Long life. Sensors in continuous use for 8 years are still functioning normally.
High reliability even when exposed to toxic gases.
Detects low concentrations of Natural Gas, Carbon Monoxide and a range of toxic gases.

# 812 General purpose combustible gas detection. Carbon Monoxide detection. High CO sensitivity enables most types of smoke to be detected.

# 813 General purpose combustible gas detection. Methane detection. High CH_4 sensitivity makes it suitable for Natural Gas detectors.

HILLS TV ANTENNAE

Designed to provide the best possible reception in your area.
Built to highest electrical standards.
Simple, lightweight, strong and easy to install.

EFC-2	METRO ANTENNA	$58.26
FM3	OUTDOOR FM ANTENNA	$23.51
TC10	UHF-CHANNELS 21-37	$28.30
TC18	UHF-CHANNELS 21-37 HIGH GAIN	$38.25

Mail or phone orders add $2.00 up to 1kg pack post
Special rates for heavy items on request

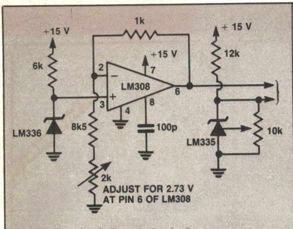


Figure 9. A centigrade thermometer circuit.

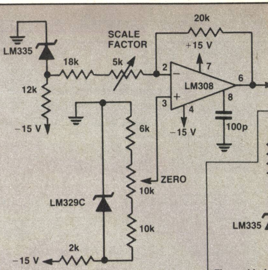


Figure 10. A centigrade therm with output referenced to grou

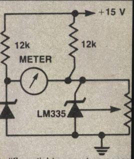


Figure 11. A differential temperature senso

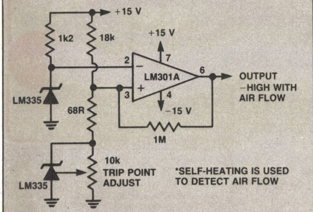


Figure 12. A differential temperature sensor with amplifier gain of ten.

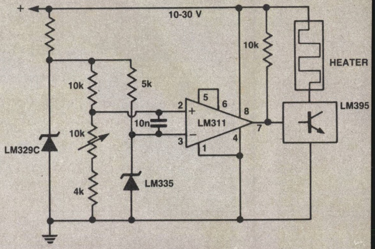


Figure 13. A thermostatic heater controller.

temperature; the 2.73 V reference effectively subtracts 273° C from the absolute temperature indicated by the output from the LM335 circuit to leave the Centigrade temperatures to be displayed by a digital voltmeter set to an appropriate scale.

Neither of the outputs from the circuit of Figure 9 are at ground potential. The slightly more complex circuit of Figure 10 provides an output of 10 mV/° C referred to ground. It employs an LM329C 6.9 V precision reference voltage device to provide a variable preset voltage to the non-inverting input of the LM308 operational amplifier. The latter takes its inverting input to a feedback network involving the LM335 temperature sensing device.

Differential sensors

Two LM335 devices in different positions can be used in the simple circuit of Figure 11 to measure the temperature difference between the two positions. Only one calibration control is required to give a zero difference when the two devices are at the same temperature.

In Figure 12 an operational amplifier is used to compare the outputs of two LM335 devices connected as in Figure 11, but the negative feedback circuit is arranged to provide a gain of ten so that the output from the amplifier is the Centigrade temperature difference in 100 mV/° C.

Temperature controller

A simple temperature control circuit which adjusts the current through a heater to maintain the temperature at some constant desired value is shown in Figure 13. The LM329C provides a precision 6.9 V reference, the fraction of this reference voltage which is tapped off and fed to the non-inverting input of the LM311 being adjusted by the temperature setting potentiometer.

If the temperature of the LM335 is high enough for the voltage from it (which is fed to the inverting input of the LM311) to exceed that of the non-inverting input, the output of the amplifier will be low so that the LM395 passes only a very small current through the heater. If the LM335 temperature falls, the LM311 output rises and switches on the LM395 so that current passes through the heater. The LM395 is actually an IC which behaves like a very high gain power transistor.

Air flow detector

In the circuit of Figure 14, a fairly high current is passed through the upper LM335 so that the device becomes warm. If air flows fairly quickly past this device, it will be cooled and its output voltage will fall. As this voltage is connected to the inverting input of the LM301A device, the output of the latter will become 'high' when such a fast air flow occurs. the lower LM335 (not in the air flow) is used to provide a comparison voltage by keeping the ambient temperature around the two LM335 devices the same.

Fast NiCad charger

Nickel cadmium cells can be fast charged only if precautions are taken to ensure that the temperature of the cells does not rise above a permissible limit. In the circuit of Figure 15, the LM335 diode D2 is placed in close thermal contact with the Nickel Cadmium cells being charged. If the temperature of the cells rises, the output from D2 rises and, as this output is

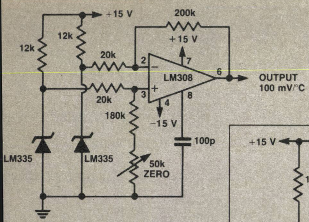


Figure 14. An air-flow detector.

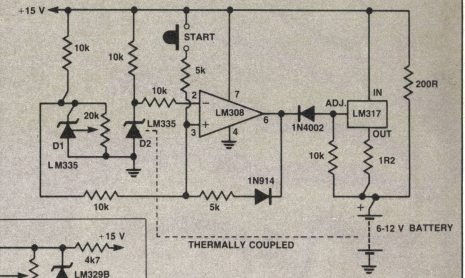
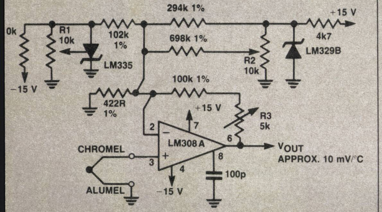


Figure 15. A fast charging circuit for Nickel Cadmium batteries with temperature monitoring and automatic switch-off in the event of over heating.



igure 16. A centigrade calibrated thermocouple ectronic thermometer.

ed to the inverting input of the LM308, he output of this operational amplifier alls.

Current passing from the 'ADJ' terminal f the LM317 regulator to the LM308 auses the potential at this terminal to fall o that the regulator no longer passes the harging current to the nickel cadmium ells. The non-inverting input potential is erived from the other LM335 which is at he ambient temperature. Thus the tem-erature of the cells is compared with the mbient temperature, as required. The alibration potentiometer across D1 may e adjusted so that the voltage across this M335 is 50 mV greater than that across 2. The charging will then be terminated hen the temperature of the cells rises by ° C above ambient.

Thermocouple application

hermocouples are much used for making emperature measurements over a much ider range than is possible with the M335, partly because they are very heap and simple. Although thermo-ouples can be used for measuring tem-eratures of up to some thousands of degrees Centigrade using a junction of two different materials, a cold reference junction is required, often an ice bath, except when differential measurements are being made.

Rather than use an ice bath it is often more convenient to employ a technique known as cold junction compensation in which a compensating voltage is added to the output of the thermocouple so that the reference junction potential seems to be at 0° C, although it is actually at another temperature. The added voltage can be made proportional to temperature with the same constant of proportionality as the thermocouple so that changes in ambient temperature have no effect on the output voltage.

The LM335 temperature sensor is very suitable for use in the cold junction compensating circuit owing to its very linear voltage/temperature characteristics. In addition, as the LM335 voltage extrapolates to zero at the absolute zero of temperature, the temperature coefficient of the compensation circuit can be adjusted to room temperature without any temperature cycling.

A thermocouple thermometer calibrated in degrees centigrade is shown in Figure 16. The thermocouple reference junction should be terminated in close proximity to the LM335 so that their temperatures do not differ appreciably. Initially a signal should be applied in place of the thermocouple and R3 adjusted for a gain of 245.7. The non-inverting input of the LM308A should be shorted to ground and R1 adjusted so that the output voltage is 2.982 V at 25° C. The short should now be removed from the non-inverting input and R2 adjusted for an output of 246 mV at 25°C. The thermocouple connections should now be replaced.

Electronic thermometers of this general type can provide a 10 mV/° C output over a 0° C to 1300° C range, but it is important to use good quality cermet trimmers and stable components.

Further thermocouple circuits together with practical information on their construction using LM335 cold junction compensation is available in the *National Semiconductor Linear Applications Handbook*, as Application Note AN-225, April 1979. ●

"10-OVER 50% OFF SALE"

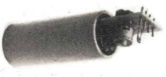
FM TRANSMITTER MODULE

We have been working on this one for years!!
Basically we wanted something akin to the $6.50 kit "wireless microphone" transmitter but with greater signal strength and far, far greater frequency stability.
WE NOW HAVE IT!
Basically the (potted) unit measures a small 90x22x15mm and has connections for power, antenna and input. An AC signal between 20 and 15kHz will modulate the transmitter. The signal can be coded single or multiple frequency tone bursts etc.
FEATURES:

- Ultra low noise output (-60dB or better attainable with suitable tuner)
- Excellent frequency stability
- Not a kit - ready for immediate use
- Connections required
  - (a) Power supply or battery
  - (b) Antenna
  - (c) Audio input
- Full instructions supplied
- Suits any application where a stable low noise FM link is required.
- Frequency - 88 - 108MHz adjustable
- Useable range - 50 metres
- Supply - 6 to 9 volts at 20mA
- Input sensitivity - adjustable - maximum 30mV
- Pre-emphasis - 50u/second standard
- Dimensions - 90 x 22 x 15mm (approx.)

Cat. DT-5450

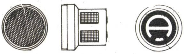
ONLY $49.95



UNIDIRECTIONAL ELECTRET MICROPHONE INSERT

Just out in time for the new EA Parabolic Microphone project! (Ref: EA November 1983). This brand new direct import unit has an average sensitivity around 7dB BETTER than the common low cost Electret insert.
The unit has a front to back ratio of 1.5:1. The power requirements are the same as for the low cost mic. insert. Each insert is supplied with a comprehensive data sheet which includes connection details, specs., and frequency response graph.
Cat. AM-4012

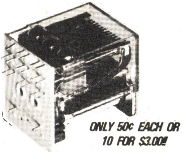
ONLY $3.95



QUALITY!! "USELESS" COIL VOLTAGE ANRITSU JAPANESE RELAY

- As used in Telecom equipment
- 6 changeover contacts!!
- 48 Volt Coil?

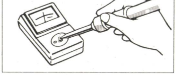
48V Coil?!!!
How useless you say?
Well, if you can find a use you won't pay much!
Cat. SY-4015



ONLY 50¢ EACH OR 10 FOR $3.00!

EASY TO USE!

Apply solder to the tip of soldering iron and then press the temperature sensor as shown



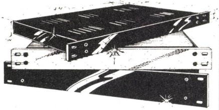
SOLDERING IRON TEMP TESTER

READS TEMP IN DEGREES CENTIGRADE!
IDEAL FOR ALL TEMP CONTROLLED IRONS

Temperature is the most important factor for soldering!
Prevent precision parts from burning intermittent connection.
When you solder electronic parts to the PCB, you should know the proper temperature.
Improper temperature can cause damage to parts or cold soldering.
Cat. QT-2100

ONLY ~~$29.95~~

SAVE $10
NOW ONLY
$19.95



RACK CABINETS

Beautifully crafted all Aluminium rack cabinets with top and bottom removable panels. Plain or black finish. Ventilated lid. Deluxe brushed anodised front panel. Supplied in flat pack but takes only minutes to put together. Dimensions conform to International Standard.

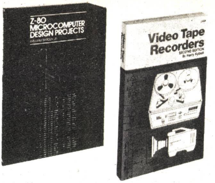
Cat. No.	Finish	Price 1-4	Price 5 up	Front panel ht.
HB-5411	Natural	$42.50	$39.95	44mm
HB-5413	Natural	$49.95	$47.50	44
HB-5415	Natural	$55.00	$49.95	88
HB-5410	Black	$42.50	$39.95	88
HB-5412	Black	$49.95	$47.50	132
HB-5414	Black	$55.00	$49.95	132

MASSIVE SAVINGS!! INSULATION DISPLACEMENT DB-25 SOCKET

- QUALITY U.S. MADE PRODUCT
- GOLD PLATED CONTACTS
- NORMALLY HARD TO GET AND EXPENSIVE

Cat. PI-6576

SPECIAL FOR FEB ONLY
$3.95 NORMALLY $8.95
SAVE $5.00



Z-80 MICROCOMPUTER DESIGN PROJECTS

Gives you a solid, in-depth look at the highly popular Z-80 microprocessor, the heart of many contemporary microcomputers providing a complete look at the internal architecture of the Z-80, and even shows how to build a microcomputer, the EZ-80, using this powerful chip. The book may be used by the experienced electronics enthusiast as a training course and is also highly valuable to the computer hobbyist. By William Barden, Jr. 208 pages, 8½x11" soft.

Cat. B-0596 .... $23.95

VIDEO TAPE RECORDERS

(2nd Edition)

In this completely revised 2nd edition of Video Tape Recorders, the author tells in simple language how helical VTR's work and how to operate or service them. Includes numerous examples of electronic circuits and mechanical systems. By Harry Kybett. 400 pages, 5½x8½" soft.

Cat. BS-0610 .... $15.95

TELEPHONE PUSH BUTTON PAD

High quality heavily gold plated (over 90¢ worth of gold in each unit) contacts! (Each contact is a type of double-wipe changeover). Very high quality, as removed from imported telecommunications equipment. Virtually brand new. Each of the 12 keys is separately addressable. The possibilities are endless!!
Cat. SP-0750

ONLY $3.95 EACH
GRAB A FEW. THEY WON'T LAST!

QUALITY "AIRPAX" DC CIRCUIT BREAKER

Unbelievable bargain. Quality Airpax U.S. made unit features large on/off rocker switch and snap-in panel mount capability.
SPECS.

- Trip current 10 amps
- Full load 8 amps @ 50V DC
- Delay 59mS
- Measures: 35(d)x40(h)x18(w)mm body only

Cat. SY-4080

ONLY $2.95 EACH OR 10 PLUS $1.95 EACH

CODEMASTER

SAVE 50%

his is a very popular game that is well known under another name! he Codemaster measures 140(l)x85(w)x25(d)mm, looks similar to a ocket calculator and runs off a 9V cell. The idea of the game is to ome up with the hidden code in the minimum of moves.
at XM-7015

ONLY $4.98

10 UP $4.50 EACH

ONCE SOLD FOR $24.50!!

"MAGNAVOX" QUALITY 8" WOOFER

POPULAR MODEL 8J
8 ohm 8" widerange
- power handling 12W r.m.s.
Frequency Response 55 - 7000Hz
Cat CE-2333

$7.50 EACH

6802 CPU - 8 BIT MOTOROLA

- *ARE WE NUTS?*
- *Normally $15.95 each*
- *Brand new stock*

FEB ONLY $9.95
Cat. ZZ-8050

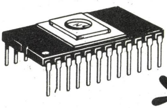
REMEMBER! JAYCAR PRICES *INCLUDE* SALES TAX!

2708 EPROM - ARE WE CRAZY?

- *You normally can't get them!!*
- *They normally sell for $7.95 from us (which is cheap)*
- *Limited Quantity*
- *Offer strictly limited to February*

Cat. ZZ-8450

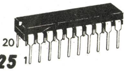
ONLY $4.95



74C922 16 KEY ENCODER IC

- *½ PRICE FEBRUARY*
- *Normally $9.50*
- *Feb only $4.25*
- *Brand new stock*
- *HURRY!!*

Cat. ZC-4922

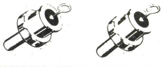


ONLY $4.25

300 VOLT 10 AMP STUD RECTIFIER

- definitely DO-4 stud case
- Not fast - but CHEAP!
Cat ZR-1042

1-9 60¢ 10 UP 40¢ EACH



MOTOROLA STUD RECTIFIER 1N3890

- *DO-4 CASE*
- *40 AMP, 100V*
- *FAST*

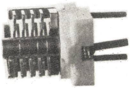
Once again a small quantity. Don't cry when we said "I told you so". A high current fast rectifier can come in handy sometimes. Don't wait until you need one. These are cheap for *SLOW* rectifiers!!
Cat ZR-1040

$1.50 each $1.00 10 up

YOU'LL FALL IN LOVE WITH THIS ONE!

A rare beauty. Quality English made air-spaced tuning/trimming capacitor.
It measures a petite 13mm(h)x10mmx10mm
- Ceramic base
- All plates (rotor and stator) silver plated
- Unbelievable quality
Cat RV-5724

ONLY $1.50
WORTH FAR MORE



SCOOP!

8" CEILING GRILLES

- Will they ever be this cheap again?

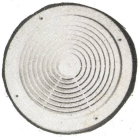
Once again - a massive scoop purchase with a difference. We have purchased a very large quantity of 'reject' grilles. They are rejects because they have small flaws in the mouldings. Most people however cannot pick the flaws if allowed to examine the grille. Imagine what the flaws look like *9 feet up* on the ceiling! Naturally we are offering a massive saving over normal units which we also sell. Exactly the same units (sans flaws) have been sold throughout Australia in the 10's of 000's. The perfect ones sell for around $2.95 - at least one company sells them for well over $3.00.
Cat AX-3560

WHAT PRICE US?

1-4 units	$1.50
5-19 units	$1.25
20 plus units	$1.15

PRICES INCLUDE TAX
P.A. INSTALLERS - GO FOR IT!

TAKES STANDARD 8" SPEAKERS



THE ALL SINGING ALL DANCING MULTIMETER

Scoop purchase of quality "KAISE" Japanese 3½ digit LCD digital multimeter.

- Manual range overide (normally auto ranging)
- A must. Zero adjust button. Calibrates meter if you change test probes.
- Virtually "open circuit" input impedance
- Magnificent clear LCD readout
- Most significant digit flashes if out of range
- Tone beeper for status identification
- #1000V DC, 600V AC
- Resistance & current ranges (AC & DC)
- Lo ohms range for checking semis
- 4mm banana plug leads on industry standard 19mm centres
- High current shunt available
- Fuse protected. Spare fuse provided.
- Includes case

Cat QM-1525

ONLY $59.95

SPECIAL NOTE

Jaycar will not be knowingly undersold FOR GOODS OF THE SAME QUALITY. If you find that a competitor is cheaper, get all the facts and tell us! If you are right we will match OR LOWER his price!
Please understand that we cannot match the price of goods that are NOT the same quality as ours.

Jaycar Incorporating ELECTRONIC AGENCIES

SYDNEY SHOWROOMS
117 YORK STREET – PHONE: (02) 264 6688 and (02) 267 1614
TELEX: 72293
CARLINGFORD
Cnr. CARLINGFORD & PENNANT HILLS ROAD – PHONE: (02) 872 4444
CONCORD
115 – 117 PARRAMATTA ROAD – PHONE: (02) 745 3077
HURSTVILLE 121 FOREST ROAD – PHONE: (02) 570 7000

NUMBER 1 FOR KITS

POST AND PACKING CHARGES

$5 – $9.99 ($1.50)	$10 – $24.99 ($3.20)
$25 – $49.99 ($4.50)	$50 – $99.99 ($6.50)
$100 – $198 ($8.00)	Over $199 ($10)

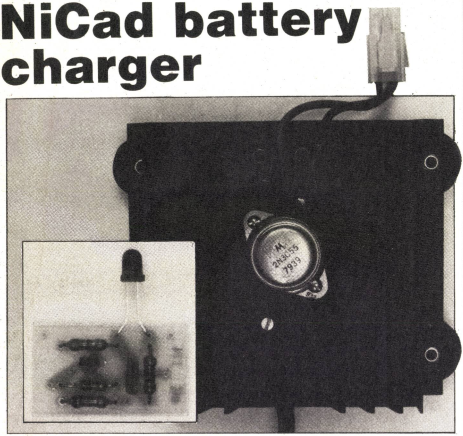
"Free INSURANCE for Road & Registered Post over $200"
All heavy or bulky items (over 20kg.) sent Comet Road Freight $12.00 anywhere in Australia.
SHOP HOURS CARLINGFORD, CONCORD & HURSTVILLE
Mon – Fri 9am – 5.30pm: Sat – 9am – 12pm: Thurs night 8.30pm
SHOP HOURS SYDNEY
Mon – Fri 8.30am – 5,30pm. Sat – 8.30am – 12pm: Thurs night 8.30pm
MAIL ORDERS AND CORRESPONDENCE: P.O. Box 185, Concord, 2137

Mail Order By BANKCARD Via Your Phone

CHECK OUR CONCORD STORE FOR SATURDAY AFTERNOON TRADING IN FEBRUARY

Project 274

A *damn fast* NiCad battery charger



This project is specifically designed for modellers, photographers and hobbyists who make heavy demands on NiCad batteries quite routinely. There's nothing more frustrating than having your RC model run out of juice as it runs out of sight, or your flash run out of flash at an inopportune moment. If you use NiCads and need a charge — but quick — this project is for you!

Jonathan Scott

SMALL Nickel-Cadmium cells are often employed to replace frequently-used dry cells because they work out cheaper after a lot of recharges, and also because they save you a lot of walking to the corner store to purchase replacements.

There are, however, some properties of these types of cells which enable them to perform tasks other batteries cannot. Most notably, they have a lower internal resistance for a given cell size: A typical penlight NiCad has twenty times less internal resistance than its equivalent dry cell. This means that a lot of power can be drawn from them in a short space of time. They can thus perform a task which demands lots of power over a short period out of a small set of cells. There is a price to pay for this; namely, short cell life. They also exhibit a low total ampere-hour (Ah) capacity under fast discharge conditions.

The most notable use for these properties is the powering of models, particularly aeroplanes and racing cars. Such devices are expected to weigh little and develop a lot of engine power over a short space of time. A set of dry cells simply cannot achieve this. An electric aircraft will typically carry one or two cells and flatten them inside three minutes; a land craft may carry five or so large cells and flatten these inside fifteen minutes. Of course, the cells suffer a great deal for this kind of treatment and tend to expire after ten to twenty uses in the three minute case, or twenty to fifty uses in the ¼-hour case. There are two upshots of this; firstly, the user typcially wants to be able to recover and re-use the cells often in one day, and secondly, he does not really care if the recharge process thrashes the cells a lot, because their discharge is going to kill them fairly quickly anyway.

Toward the goal of charging cells quickly, ETI published a Fast NiCad Charger (Project 563) some time ago (July 1989). This was a mains powered device which incorporated a timer and some sophisticated electronics to make the unit fairly foolproof. While there is no doub that this project found a home in many a modeller's kit, it was designed at the general level, rather than a specifi market. There is a need for a somewha simpler and yet more powerful charger designed to run off a car battery or simila portable power reserve, capable o substantially more rapid a current delivery again. This project is it.

Let me stress once again that this unit i *not for genral use;* there is a detrimenta effect on healthy cells when asked to deliver large currents over short periods. This project also does not have the foolproof nature (or the complexity) o the ETI-563 Fast Charger and can completely cook a battery if left on too long. It is designed for use out in the field where the cells it is charging are needed *damn* fast, and at any price. For a more detailed discussion of the merits and limitations of fast NiCad Charging, you are referred to the article accompanying the ETI-563 Fast NiCad Chrger.

Design details

The circuit is basically a constant curren source, delivering a preset current (up to amps) into a load, using a dc voltage source of about three volts more than the voltage which will be required by the load. It uses only common components and hal watt resistors so can be constructed with a minimum of effort. Notably, no hig power "current sense" resistor is necessary as these often tend to be tricky things to purchase or build — where do you get a 0.075 Ohm, 5 watt resistor? All that i necessary for its construction can be purchased from just about any electronic supplier in the country.

Construction

Before proceeding with the construction o this project there are two things which must be decided. The first is the curren you wish to set the regulator to deliver, and the second is the scheme you wish to us to protect the circuit against reverse connection of the supply (typically a car battery). The former is a function of the ampere-hour capacity of the cells you will be charging.

I envisage that the regulator will be used in a fairly rugged environment for charging a single type of cell; therefore the current is set to a predetermined value, eliminating the cost and unreliability of a switch and set of resistors, not to mention the possibility that the switch will be miss-set in operation.

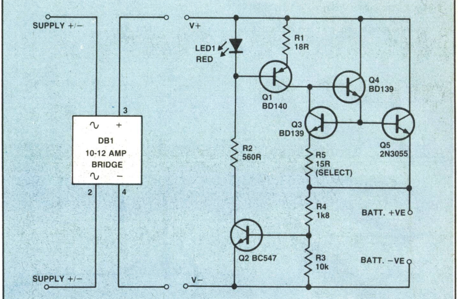
Should you wish to include one, there is nothing to prevent you adding a double or multiple throw switch and a selection of resistors to give a selection of current ranges, but I will proceed here assuming that there will be one current only required. (To effect range selection all that is needed is to switch the emitter resistor of Q3 using a toggle or rotary switch; a pot is not recommended, though a 100R wirewound type would be sufficient).

It seems from experience that the highest safe charge rate for a NiCad is around 4C (C is the cell's Ah capacity) or that current which equals the Ampere-hour rating multiplied by 4/hour. Thus, a 450 mAh battery should be charged for up to about 20-25 minutes at a time at just under two amps. An 1800 mAh battery would accept charging at just over seven amps.

The project described here is capable of up to eight amps guaranteed, and may be 10 A typical. The exact value depends upon many variables concerned with the particular parameters of the specific transistor used for Q5. For a 2N3055, as specified, I have given approximate values required for R5, but the exact value will probably need to be selected, as indicated in the circuit diagram. Fifteens Ohms gave 6 A, on my prototype. Eighteen Ohms gave 5 A and 12 Ohms gave 7 A. To get down to 2 A required 33 Ohms. Using three values as a guide, choose an initial value of R5, but remember that this value may have to be changed later.

The second thing to be decided, once you have chosen the current required, is the protection scheme. There are three ways you can tackle this. I think it would be foolhardy, to say the least, not to include some protection from reversed supply, particularly as the unit is to be used in a hurried situation in the field. The first method is a single diode, the second is to use a diode bridge, and the third is to use a relay.

Clearly, this decision will be influenced by the cell or battery voltage. A NiCad being fast charged drops up to 1.5 volts. The actual regulator section requires typically three (worst case four) volts 'overhead'. If you are using a car battery it can be expected to deliver almost 12 ▶



HOW IT WORKS — ETI 274

Referring to the circuit diagram, it can be seen that Q4 and Q5 form a Darlington series-pass regulator element. Q3 acts as a comparator, while Q1 acts as an active current source load for Q3. Q2 provides short circuit foldback limiting, while LED1 indicates correct operation and provides a reference.

Initially, consider that there are a few volts across the battery connected to the ouput. Q2 is biased on via R4 and has a collector current of typically 15 mA or so. This current is set by R2. Assume that the supply is around 10 to 12 volts. Thus, Q1 will be biased on. If Q1 is in the active state it acts as a current source delivering approximately 55 mA to the collector of Q3 and base of Q4. Q4 and Q5 will be biased on and hence their combined collector currents will be delivered to the battery.

For a collector current of five amps, the internal resistances of a 2N3055 gives a base-emitter voltage not of the 0.8 V value which might be expected from an ideal exponential device, but more typically 1.2 volts. This circuit will use this internal b-e resistance, already allowed for in the transistor's dissipation specification, as the current sensing element.

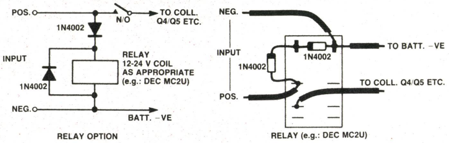
Now, recall that Q1 is delivering a fixed current to be divided between the base of Q4 and the collector of Q3. Q3, which is in close thermal contact with Q5, has a Vbe which is nearly the same as, and tracks that, of Q5. The voltage component of Q5's Vbe, which is due to its emitter current times the internal b-e resistance mentioned above, is substantially placed across R5. Hence, the collector current of Q3 is nearly a constant multiplied by the emitter current of Q5, the current delivered to the load (battery).

There is an equilibrium point where the current drawn by the load produces a collector current in Q3 which exactly leaves sufficient current left over from that suplied by Q1 to feed the base of Q4. Should the load current rise above this point the collector current of Q3 would rise also, removing some drive current from Q4, reducing the load current. Conversely, if load current falls, Q3 leaves more current for Q4, restoring the load current. Hence, current regulation is achieved. R5 affects the ratio of load current to Q3 collector current and so may be selected to define the load current at equilibrium.

Two further effects are utilised. Should the load voltage fall below about 1.1 volts, the level for one cell, Q2 will be biased off, extinguishing LED1 and shutting down the current regulator Q1. This reduces output current, effectively shutting the circuit down. This will occur should either a short circuit or a reverse battery connection occur on the output. It is thus not possible to reverse charge the cell(s) or to overheat the regulator by operating into a short. This shutdown condition is betrayed by the LED extinguishing. In addition, if the load voltage rises too high for the regulator to run properly, as is the case if there is a bad or open connection, Q1 will saturate, reducing the voltage across LED1, again extinguishing it. Thus, the LED indicates successful delivery of current to the load.

If a diode bridge is installed in the supply line it does not matter which way round the supply is connected. A single diode will simply shut the circuit off if connected wrongly, but drops about 0.8 volts, compared to 1.6 volts with the bridge. If neither of these voltage drops is acceptable, a relay may be used to protect the regulator from reversed supply. The regulator requires about three volts of overhead, so the protection scheme must be selected with the available supply voltage and the required load voltage in mind, as described in the text.

Figure 1. Although the relay option is expensive, it can charge a large number of cells at one time. The voltage drop is negligible and the power dissipation is low.



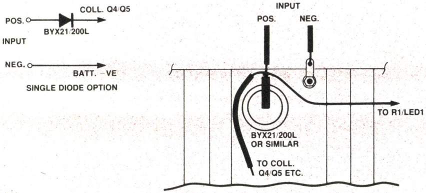


Figure 2. The single diode option is cheap, has a voltage drop of about 0.8 V and average power dissipation.

volts. Hence, it may be shown that a relay which drops negligible volts allows five cells in series (nominally a 6¼ volt stack) to be handled from one car battery, a single diode allows four, as does a bridge — just. (The sum here is V supply-4 divided by 1.5 for the relay, Vs-4.9 divided by 1.5 for the single diode, and Vs-5.8 divided by 1.5 for the bridge).

Although the bridge costs a little more than a single diode it allows you to ignore the polarity of the supply connections as the circuit effectively 'rectifies' the input to give the correct polarity irrespective of supply orientation. If you can afford the voltage drop, it is the best method, particularly as bridges of the appropriate power rating are simpler to mount and connect to than their equivalent diode counterparts. The relay option (see Figure 1) is expensive and is really only recommended for those situations where it is the only resort to obtain the capacity to handle the required number of cells. The supply can be up to 24 volts nominal, so this should not be necessary.

I recommend the bridge option as this seems the best and most convenient choice. It entails a few dollars more in cost than the single diode, but it is easier to mount and easier to use.

Having decided upon the circuit elements, the current to be delivered and the voltage into which it will be delivered, you are fixed. The next step is to figure out how much heatsink is needed. If you are using a 12 volt supply and delivering 6 A or less a '4"' heatsink is adequate. (These are generally rated to dissipate 2° C/W in still air). However, if the product of supply volts and current is in excess of about 70, a larger heatsink is to be recommended. Remember that the circuit may have to dissipate almost that figure in watts worst case, so it is a good idea to have the capability. In any case, if the 2N3055 case gets hot enough to boil water the heatsink is too small! (It is not unusual for it to get rather too hot to touch when working very hard, so don't let that worry you).

You are now ready to obtain the components and commence the actual construction. The first step is to drill the heatsink. If you are duplicating the prototype, follow the diagram here. Otherwise, you can set out the parts as you see fit. It is good practice to put the main heat disspiating element, the 2N3055, near the centre of the dissipating surface.

I used terminals on the output of the unit and had a fixed automotive grade ('heavy duty') cable for the battery connection, but you should use whatever connection will best suit your application. For instance, you may have some standard kind of plug to fit your models, or whatever, or perhaps you many want to use car battery bolt-on connectors on the input. Be sure to make provision to clamp any cables. Also remove any burrs and dags that could penetrate insulation washers on the transistors.

Next, fit the transistors and diode or bridge, etc, to the heatsink. Fit the terminals and/or clamp the cables in place. When all the parts that need to be secured to the heatsink have been bolted in, put the assembly aside. Now solder the four resistors and two transistors (Q7, Q2) to the small pc board, as shown in the overlay. This can be mounted either on the heatsink (if it's big enough) or inside a zippy box bolted to the heatsink.

Finally, interconnect all the components as shown in the wiring diagram. It is convenient if Q3/4/5 have been mounted close enough together to allow their leads to join directly. Resistor R5 is wired directly in place.

After carefully checking the wiring (remember that a mistake can easily incinerate the whole lot in one fell swoop) apply the supply. Confirm that the 'Batt + VE' terminal is indeed at nearly the full supply. Connect a load. If you have an old set of NiCads, or a headlight globe, use this instead of a good set at first. Measure the current being delivered. If it is too high, replace R5 with a resistor of larger value, or vice versa. You will be able to pick the correct value on the second or third attempt no matter how far out the original estimate. Check that either shorting the output or leaving it open causes LED1 to go out. If this is the case, all is well and you're set to go. ●

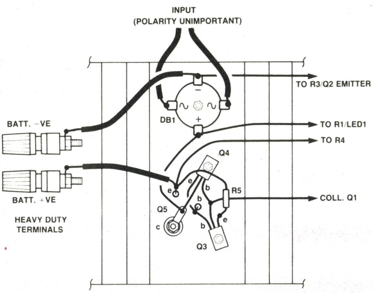


Figure 3. The diode bridge option costs a little more than the single diode but its advantage is that it can be connected in either way ignoring the polarity of the supply connections. It dissipates more power than the other options and has a voltage drop of about 1.7 V.

PARTS LIST — ETI-274

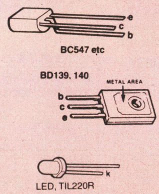
Resistors	all ½W, 5%
R1	18R
R2	560R
R3	10k
R4	1k8
R5	12-33R, see text
Semiconductors	
DB1	10-12 A bridge rectifier (PA40F or similar)
LED1	TIL220R red LED
Q1	BD140
Q2	BC547, BC107
Q3, Q4	BD139
Q5	2N3055

Miscellaneous

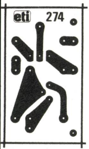
ETI-274 pc board; UB2 zippy box (if required) 60 x 113 x 196mm or similar; 100mm heatsink or larger; heavy duty terminals; heavy duty figure-8 cable (coded red/black); TO-220 transistor insulating and mounting hardware (two sets); TO3 mounting hardware; hookup wire — medium and heavy duty; nuts, bolts, etc.

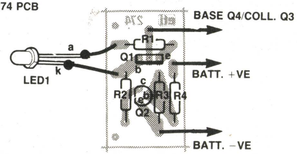
Price estimate $22-25

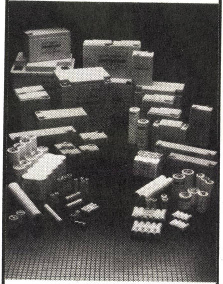
COMPONENT PINOUTS



ETI-274 PCB






POWER PS SONIC
HAVE
THE ANSWER!

SPECIAL BATTERY
ASSEMBLIES AND PACKS

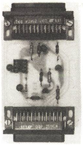
Introducing our new welding facilities at our Sydney warehouse to specially pack any cells in any configuration to meet all electrical and dimensional requirements. Write or phone us immediately.

IMMEDIATE
DELIVERY!

POWERSONIC
AUSTRALIA
Shop 42-43, 61-69 Buckingham
Street, Surry Hills
Phone: 669-2722 or 699-2521
Telex: AA75015
P.O. Box 171, Darlinghurst 2010

THIS MONTH'S KITS

ETI-274 damn fast NiCad charger
This project is specifically designed for modellers and photographers who make heavy demands on NiCad batteries quite routinely. There's nothing more frustrating than having your RC model run out of juice as it runs out of sight, or your flash run out of flash at an inopportune moment. If you use NiCads and need a quick charge then this project is for you.



ETI-676 RS232er for the Microbee
The Microbee, among other home computers has a 'sort of' RS232 port in that it doesn't inplement the negative-going portion of its output signal (TxD). Most peripherals with an RS232 input can cope with that, but inevitably, there are those that can't. This project fixes that.

—KITS—KITS—KITS—KITS—KITS—KITS—KITS—KITS—KITS—

Project HE-123 — Alien Invaders.

Save your money —
build your own space game

$10.00

Project 492 Sound Bender

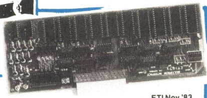
Want to sound like "Darth Vader", the "Cylons" or the "Daleks"? Then this is just for you

$27.50

Project HE-106 — Radio Microphone.

All kinds of uses for this microphone/transmitter Only needs an ordinary FM radio to detect its signals

$9.50



ETI Nov '83

ETI-673 MICROBEE
MULTIPROM INTERFACE
This project allows extension of the Microbee's ROM capacity. It plugs into the Bee's 50-way expansion buss and can either be fitted inside or externally, giving 11 open-collector outputs and eight buffered inputs. Turns your microbee into a really versatile machine.

ETI Nov '83

ETI-272 AUDIO POWER LEVEL INDICATOR
This is a simple project that employs three LEDs. To suit installation in the series 4000 or series 5000 amplifiers. This project is more useful than a simple clipping indicator (your ear is better at that!) and cheaper and easier to install than a bargraph level display.

ETI-164 ZENER TESTER

ETI MAY '83 $9.50

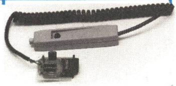
A simple, low cost add-on for your multimeter. This checks zeners and reads out the zener voltage directly on your multimeter. It can also check LEDs and ordinary diodes.

$17.00

ETI JAN '83

ETI-334 AUTO TESTER

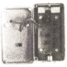
Just the thing to keep in the glovebox or toolkit to find those nasty electrical bugaboos that occur at awkward times. Simple to build, simple to use.



$18-50 ETI Aug.

ETI-649 LIGHT PEN FOR THE MICROBEE

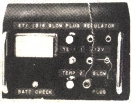
Another for the 'Bee bugs! This simple, low-cost device just plugs into the parallel port and works on the lo-res graphics.



ETI Nov '83

ETI-1514A/B SOLID-STATE RELAYS
Two solid-state switches for remote control of mains-operated devices or appliances. These allow safe interfacing between a computer or other controller and mains equipment.

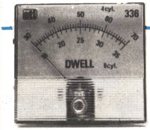
Errors & omissions excepted.



ETI-1516 $41.50
MODEL ENGINE IGNITION SYSTEM

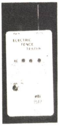
ETI JUNE '83

Get sure starts every time and no more glow plug burnouts on your model engines.



$18-50 ETI Aug.

ETI-336 DWELL METER
Save money and tune-up your own car. This simple to build project can be used on engines with 3-4-5-6-8 or 12 cylinders with the appropriate meter scale



ETI-1512 ELECTRIC FENCE TESTER

$24.50

ETI FEB '83

No more checking the 'feel' of a fence with a blade of grass (and maybe ending on your . . .). This project tells you how much your fence energiser delivers and can be used for fault-finding on a fence.

ETI-1515 DRILL/BLENDER SPEED CONTROLLER

$27.50 ETI APRIL '83

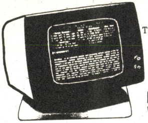
This project provides a full range of speed control for appliances having 'universal' ac motors. Once the speed is set, the motor will maintain that speed from no-load to heavy-load. Great for drills, blenders, grinders, etc.

ROD IRVING ELECTRONICS
425 High St., Northcote, Vic. 48-50 A'Beckett St., Melb., Vic.
Phone (03) 489 8866, (03) 489 8131, Mail Order Hotline (03) 481 1436
Mail orders to P.O. Box 235 Northcote 3070 Vic. Minimum P & P $3.00.

bankcard

Please address tax exempt, school, wholesale, and dealer enquiries to:
RITRONICS WHOLESALE
1st floor 425 High St. Northcote 3070 (03) 489 7099
(03) 481 1923 Telex AA 38897

HIGH-RES GREEN SCREEN MONITORS



TILT/SWIVEL BASE

$159

EVEN LESS WITH TRADE-IN

Special Purchase!

50 ONLY AVAILABLE, EX-STOCK

HIGH CLARITY, RESOLUTION AND PERFORMANCE, 18MHz bandwidth, tilt & swivel base, 90 day warranty, all for $159 (freight extra $15). BANKCARD IS OK!

SPECIAL INTRODUCTORY OFFER

4 CHANNEL MULTI-TRACK RECORDER

$899

RRP $999, SAVE $100!

A creative machine close to being a musical instrument. This recorder is of most use for musicians, singer song writers and composers.

1. SIMUL-SYNC AND PING-PONG RECORDING.
By these functions you can make a complete music tape by yourselves

[SIMUL-SYNC RECORDING]
This mechanism makes multi recording possible. By monitoring the track already recorded, the new sound can be recorded on the new track simultaneously. By this way, the ensemble of four instruments can be achieved easily.

[PING-PONG RECORDING]
This is to transfer one track to the other or to combine two or three tracks on to one.

2. REAL TIME RECORDING ON 4 TRACKS SIMULTANEOUSLY.
This machine is suited for recording live performance. Four line signals can be recorded on four tracks simultaneously. The balance of each recording level can be adjusted when MIX DOWN is made, by PANPOT and OUTPUT controls

COME IN FOR A DEMO OR SEND SAE FOR A BROCHURE - OFFER STRICTLY LIMITED!

BUY NOW SAVE NOW

12 CHAN. STEREO MIXER

FOR PROFESSIONALS

R.R.P. $845.00 **$699**

SPECIFICATIONS

SAVE $146

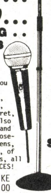
```
INPUTS:  Mic.     -46dB/1K ohms
         Line     -22dB/16K ohms
         Phono    -52dB/50K ohms stereo
                   2mV sensitivity 1KH
  Effect Return  -20dB/50K ohms

OUTPUTS: L & R     0dB/10K ohms
    Effect Send    0dB/2K ohms
         F/B Out   0dB/2K ohms
       Headphone +10dB/600 ohms stereo

EQUALIZATION:     Bass +15dB, -15dB
(Each Channel)    Treble +15dB, -15dB
```

```
CONTROLS: Channel Faders 60mm slider
          Master Fader 60mm slider
          F/B Volume Control rotary
          F/B Master Level rotary
          Effect Send rotary
          Effect Return rotary
          Phono rotary
          Headphone rotary
```

SIZE: 620W x 356D x 105H milimeters

CARRYING CASE INCLUDED: Attractive black vinyl-covered timber case free!

HELLO... HELLO... TESTING.. .1..2..3



Have you seen our range of PA gear yet? You're mad if you don't! We've got mikes, balanced/unbal., cardioid, electret, dynamic, etc, also stands, booms, and attachments, goosenecks, windscreens, mike mixers and, of course, speakers, all at DISCOUNT PRICES!

TELESCOPIC MIKE STANDS...$33.00
BOOM.....$18.90
MIXERS FROM....$34.00
MIKES FROM.....$17.50

SEND A SAE FOR OUR PA CATALOGUE OR CALL IN FOR A DEMONSTRATION.

CUTEC DIGITAL DELAY

CD-424 14 BIT P.C.M. HIGH RESOLUTION DIGITAL DELAY

* Pro quality with high signal to noise ratio and wider frequency response * Long delay time from 0 to 1,024mm/s * 8 step sub-delay preset from 5/- 764mm/s * superb combination effect with main and sub-delay * 2 inputs and 3 output levels * Low/High equalizer for sound variation

SEND SAE FOR A BROCHURE. ALL SAVINGS SHOWN ARE OFF THE RECOMMENDED RETAIL PRICES.

ELECTRONIC X'OVER

STEREO 2 WAY/MONO 3 WAY

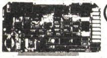
* 2-way electronic crossover in stereo * 3-way electronic crossover in mono * 8 steps dividing points from 250Hz to 6KHz * Rack mountable compact dimensions (19") * Convenient 2-way input jacks of balanced (50K ohms) and unbalanced (25K ohms)

SAVE ••• SAVE ••• SAVE ••• SAVE ••• SAVE ••• SAVE ••• SAVE ••• SAVE •••

NEW Products

FROM QT COMPUTER SYSTEMS
S100 Specialists!

① UNIVERSAL FLOPPY DISK CONTROLLER
Suits Super 80, System 80, TRS-80, Microbee or any Z80 based computer. (board fitted with std S100 connector)
- Can operate up to 4 x 8" or 5¼" drives.
- Includes DMA.
- CP/M routines for most popular Z80 systems.
- Uses WD2793 Controller



② S100 VIDEO BOARD
- 80 x 25 screen format
- Graphics resolution: 225 x 560 dot addressable
- Graphics software available

Please send SAE for further information on any products.

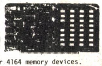
FDC-1 SINGLE BOARD ③ COMPUTER
- Z80A 4MHz or
- Z80B 8MHz option
- 2 Serial ports avail.
- 2 Parallel ports avail.
- NEC765 Floppy Disk controller
- Up to 8K RAM or ROM

Just add memory and you have a complete system - easy upgrade to multi user operation.

SPECIAL OFFER!

NOW YOU CAN SPEED-UP YOUR SYSTEM WITH 256K RAM PLUS OUR EXCLUSIVE SOFTWARE INCLUDED FREE!

256K DYNAMIC RAM



WAS ~~$995~~ NOW **$695**

NOW SAVE A MASSIVE $300

- 16K to 256K bytes; uses 4116 or 4516 or 4164 memory devices.
- Guaranteed to operate at 4MHz with no wait states (6MHz: 1 wait).
- Adjustable timing allows operation with Z80, 8080, 8085 micros.
- Can be divided into max. 16 banks, each variable in 4K add-ons.
- Each 4K segment can be individually enabled or disabled easily.
- Each bank can be located on any 4K boundary.

SAVE ••• SAVE ••• SAVE ••• SAVE ••• SAVE ••• SAVE ••• SAVE ••• SAVE •••

ELECTRO-MAGNETIC COUNTERS

BEST QUALITY
FAMOUS MAKERS
WAY BELOW NORMAL COST!

	1-9	10+
24v DC NON-RESETTABLE, PANEL MOUNTING...	$4.95	$4.40
110v AC CHASSIS MTG..	$2.50	$2.20
220v AC CHASSIS MTG..	$4.95	$4.40
15-30v DC OPEN TYPE..	$3.00	$2.55

All above either 5 or 6 digit readout.

Ideal for all types of Industrial Control applications, batch-counting, machine-usage, etc. Qty prices on application

STACKABLE MODULES

24v DC, 2 SIZES, PANEL MOUNTING.
Internal position indicator switch for remote sensing, highest quality.
PRICED WAY BELOW NORMAL COST!

SLIM-LINE MODEL WITH PCB EDGE CONNECTOR......$5.00
STANDARD SIZE, PCB EDGE CONNECTOR ($1.50)...$6.90

★ PACK/POST $2 PLUS 5% OF ORDER VALUE. ★

3 CORE MAINS LEADS

3 METRES

usually $3.30 **$2 EA.**

10-24 $1.75
25-49 $1.50
50-99 $1.35

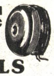
MOVING COIL CARTRIDGE

MODEL MC100

Was $49.50
- Standard ½" mounting.
- Samarium Cobalt magnets for high output- transformer not needed.
- Freq. response 15Hz-35KHz.
- Huge 2.5mV output (1KHZ/50mm/a)
- Tracking Force: 2.0 grams.
- 0.6mm Diamond stylus.
- Complete mounting kit incl.
- Stylus easily replaced ($15.00)

NOW ONLY... $24 EA

3 INCH AC/DC



3-4.5v OR 24v

BELLS

$5 10+ $4.50 EA.

High quality English alarm bells by Chloride-Gent in either 3-4.5V or 24V AC/DC models. Ideal for warning indicators, doorbells, etc.

LOUD RING DESPITE THE SMALL SIZE AND THE CHEAP PRICE!

PRE-PAK electronics p/l

1a WEST ST, LEWISHAM, NSW

569-9797
24 HR PHONE ORDER SERVICE

Phone or mail order BANKCARD accepted

JAYCAR FOR VALUE!

PIPER MOUSE

This 'microbot' is powered by 2 DC motors that drive wheels. When special ultrasonic whistle is blown, the unit goes left, right, straight ahead according to your command. Complete, including perspex dome cover! Be a Pied Piper!
Cat. KJ-6680 **$39.95**

AVOIDER

Similar to the Piper Mouse, but this unit travels on its own. It avoids objects because it has an infra-red beam system, very clever!
Cat. KJ-6682 **$44.95**

LINE TRACER

This robot will automatically follow a black line drawn onto a sheet of paper. It uses an infra-red feed back system.
Cat. KJ-6684 **$39.95**

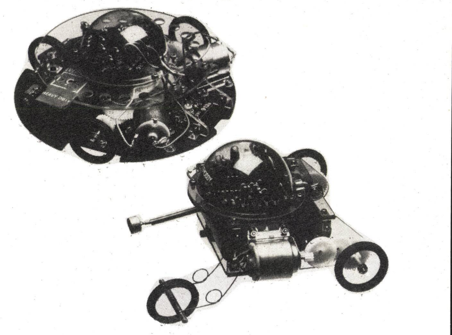
MEMOCON CRAWLER $79.95

This robot is controlled by a keyboard which is supplied. The operation of the unit is programmed by the keyboard and stored in RAM. All movements can be controlled as well by lights (beams) and sound (buzzer).
Cat. KJ-6686

Jaycar Electronics is proud to announce a range of very low cost "Turtle" like robot kits. Don't let the low prices fool you - they are not toys.

The units feature solderless connections with explicit illustrations to ease assembly. Only simple tools (i.e. screwdriver, pliers etc.) are needed to assemble.

Note: The "Microbots" work well on their own but can also be used as a platform for robotic development. If you are a robot experimenter you will find them useful as they help resolve the mechanical parts problem.



A VIDEO ENHANCER/ DISTRIBUTION AMP

DESIGNED EXCLUSIVELY FOR AUSTRALIA

Jaycar has designed a high quality, high performance Video Enhancer which is specifically for the Australian 625 line 50 frame PAL D system. As far as we know it is the ONLY Australian designed, Australian built unit available!!

But, guess what? The Jaycar AV-6501 Enhancer is CHEAPER than its inferior imported Asian counterparts!!

This unit is professionally designed and University tested! It works and it works well.
Cat. AV-6501

ONLY $59.95

IT HAD TO HAPPEN SEE EA Dec '83

A professionally engineered electronic ("breakerless") contact breaker system.

Yes, only Jaycar has a complete Hall-effect triggerhead assembly designed to adapt to an extensive number of cars. Each kit contains the following:

- HALL EFFECT TRIGGER HEAD
- MAGNETIC ROTORS FOR BOTH 4 & 6 CYLINDER CARS
- OVER 6 CAM-LOBE ADAPTORS
- OVER 12 DIFFERENT ADAPTOR PLATES FOR YOUR PARTICULAR DISTRIBUTOR
- OTHER HARDWARE (i.e. SCREWS etc.)
- YOU CAN REMOVE THIS SYSTEM AND RE-EQUIP YOUR CAR WITH THE ORIGINAL BREAKER POINTS WHEN YOU SELL THE CAR!
- AS EASY TO INSTALL AS A SET OF POINTS!
- INSTRUCTIONS (SIMPLE-TO-FOLLOW) INCLUDED

This set is designed to fit most European and Japanese cars. In fact it will also fit many Australian cars fitted with Lucas, Bosch, Motorcraft, AC Delco or Autolite electrics. If you wish to check first, please send SAE for car/distributor list.

Because we have no way of knowing, you get the fitting set for ALL of the distributors available. Basically you end up with a jar full of parts you don't need to use! (Perhaps for your next car?)

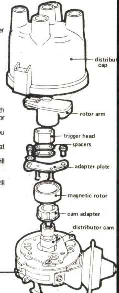
Quite frankly, we are amazed that we can supply such a comprehensive kit for this price. To produce a kit that will adapt to the dozens of different distributors around is amazing!

Remember, once you have installed a breakerless system it will never wear out and that part of your system will remain in tune FOR EVER.
Cat. KJ-6655

PLEASE NOTE: This system must be used in conjunction with an electronic ignition. The Hall Effect device will not switch enough current to replace the contact breaker points on their own!

NEW PCB FOR TAI KIT INCLUDES HALL EFFECT INTERFACE Cat. HP-8786 ONLY $3.95

ONLY $29.95



DOOR/BOOT/BONNET SWITCHES

Complete set of door/boot/bonnet switches. Consists of two switches, mounting brackets, screws, Q.C. connectors.
Cat. LE-8776 .... **ONLY $3.95**

SECURITY KEY SWITCH

Special Car Alarm Security key barrel switch. Features special neoprene rubber boot cover to weatherproof unit. Two keys supplied. Only ½" diameter hole required.
Cat. SM-1032 .... **ONLY $4.95**

* * *

PROGRAMMABLE MASTER RHYTHM GENERATOR

Fully imported

This project was originally described in the U.K. publication "Practical Electronics". We have fully imported "Clef" kit. This attractive kit is presented in an attractive metal cabinet with silk-screened front panel. The Master Rhythm can be programmed (in RAM) to play back - 24 Rhythm patterns - 8 parallel tracks - 12 instruments.
It is also capable of sequence operation - the ULTIMATE UNIT.

SEND SAE FOR DESCRIPTIVE LEAFLET
LOW POWER - BATTERY DRIVEN

COMPLETE $199

microbee®
SOFTWARE

GREAT SELECTION
OF MICROBEE
SOFTWARE IS
LWAYS AVAILABLE
FROM JAYCAR

ASTEROIDS PLUS - Mytek
steroids Plus is one of the finest high resolution graphic arcade ames available for the MicroBee. It features 3-D point by point solution graphics, shields, sound effects, intelligent objects, guided issiles, black holes and a score board. If you enjoy playing computer ames, you will be captivated by Asteroids Plus.
at. XE-6297 ....**$22.50**

FORTH
new language for the MicroBee. Comes complete with interpreter one side of the tape and supporting programs on the other side. As ell as this it includes a very well written, bound manual.
at. XE-6965 .... **$47.50**

PSYCHOTEC By Dreamcards
sychotec provides a striking example of artificial intelligence, owing a dialogue in English between computer and operator, the omputer playing the role of psychiatrist and the operator being a atient" on the couch. Leaves other "similar" types for dead.
at. XE-6875 ....**$15.95**

MERLIN By Dreamcards
erlin is a 32K adventure set in England during the dark ages. Your sk is to search through the dark forest inhabited by robbers, outlaws d creatures with awesome magic powers to find a legendary sword. excellent adventure.
at. XE-6870 ....**$25.00**

LOG - GENERAL PURPOSE INDEX
is program is designed to suit a wide range of records where dexing (and later searching) can be on one or two words, or on a ring of up to 15 characters. Each record consists of its index heading, us up to 12 lines of text. Each line can contain up to 41 characters.
at. XE-6890 ....**$15.95**

MINE DROP
ou are a tank running around a maze gathering all the supplies you n. It sounds easy, but you have a guided missile hot on your trail. our only defence is a remote controlled mine which you drop and plode at will. A very fast joystick or key controlled game.
at. XE-6960 .... **$15.95**

PENETRATOR
low resolution graphic version of the popular game "Scrambler". You ust defeat the rockets and bomb the radars in an effort to get to the xt stage which is even harder. This game can be either controlled by Joystick or by keys. Being in Lo-res graphics it is a very fast game. If u are bored with the same land pattern you can devise your own.
at. XE-6955 ....**$19.95**

METEOR RESCUE - Mytek
our mission is to rescue stranded astronauts. You are the com- ander of the Landing Module docked in space with the mother ship. is your responsibility to guide the landing module through the eteor field, down to the surface of the planet, to land safely on a nding pad. An astronaut will then run to your landing module and you ll blast off. You must use your lasers if necessary and dock with the other ship again. A total of 6 astronauts must be shuttled to the other ship.
at. XE-6285 .... **$18.50**

KING KONG - Mytek
ust like the arcade game of a similar name. The game onsists of several frames which you must complete to scue your sweetheart from Kong. Excellent graphics and ound. Joystick compatible.
at. XE-7054 .... **$22.00**

CHOPPER - Mytek
fast action packed game which must rate as one of Mytek's est. You have full control of a helicopter and you must fly er enemy lines to rescue your allies. Fast realistic graphics and cellent sound.
at. XE-7055 .... **$22.00**

SKETCH PAD
program to help you design your own P.C.G. characters. Simple ommands allow easy drawing of circles, polygons and boxes etc. ese then can be dumped to tape to be used in a future program. omes complete with manual.
at. XE-7056 ....**$19.95**

PRINTERS MATE
This program is two screen dump programs to suit CP80, MX80, DT80, 80DP and FAX80 printers. One program is a screen dump utility while the other prints out memory contents in both hexadecimal and ASCII characters. A must for use with printers.
Cat. XE-7051 ....**$17.50**

DUO - ONE
Another two programs for the price of one from Dreamcards. One side has poker, and the other is Casino which is a three reel poker machine. Both use Hires graphics. Excellent value.
Cat. XE-7052 ....**$15.95**

EXTENDED TURTLE
A "Turtle" program which has been written by a teacher and has been several months in the writing. This is one of the best Turtle programs written and comes complete with a 40 page clearly written manual with many helpful drawings.
Cat. XE-7053 ....**$29.50**

DEFENDER - Mytek
This long awaited program is finally available. Defender needs no introduction. The Defender arcade game is one of the most popular ever produced and the Mytek version is brilliant, a rival for Asteroids Plus.
Cat. XE-7036 .... **$24.50**

COULOMBS LAW
This program is another in the series of Physics simulations. The first part is tutorial and the second is a simulation of the experiment.
Cat. XE-7049 ....**$14.95**

BACKGAMMON - Mytek
This game conforms exactly to that set down in the official rules of the International Backgammon Association, including the rules of doubling and scoring.
Cat. XE-7050 .... **$18.50**

GEO-TECH DRAWING
This is the first in a series to assist students in grasping the fundamentals of geometric and technical drawing. It uses good graphics with excellent explanations.
Cat. XE-7047 ....**$14.95**

DISASSEMBLER By Dreamcards
Some may say "Not another Disassembler". But this one has a difference. It allows you to set out where the data fields are so the computer is saving time, not trying to disassemble data. A program you shouldn't be without.
Cat. XE-6915 .... **$15.95**

CHEAPIE By Dreamcards
Two top quality programs for the price of one. The best Hangman we've seen yet on side A and a superb version of Battleship on side B. Both have excellent graphics.
Cat. XE-6920 .... **$15.95**

COMPOSER BEE
This is a very well written program for music. This program allows you to compose, play, edit, transpose as well as being able to load and save your music. A program that has been a long time in the writing and well worth buying.
Cat. XE-6930 ....**$22.50**

PONTOON
A quality fast moving card game where up to 6 players can play against the computer who is banker.
Cat. XE-6940 ....**$14.95**

TRSBEE - Mytek
TRSBEE is a package of 3 programs that loads TRS-80 Model 1 and 3 program tapes into the MicroBee without any additional hardware. Although some program editing will still be required prior to their running, the majority of program typing time is saved by TRSBEE. The first program loads TRS-80 BASIC programs into MicroWorld BASIC. Most programs may then be edited and run. The second program in the package loads any TRS-80 machine code file into the MicroBee memory. The third program loads TRS-80 assembler files into the MicroBee EDITOR/ASSEMBLER. Any TRS-80 Model 1 or 3 tape may be loaded. TRSBEE opens up a whole new world of possible software on your MicroBee!
Cat. XE-7005 .... **$32.50**

HOUSEHOLD REGISTER
This program will simplify the task of determining the value of your homes contents for insurance purposes, as well as providing descriptions of all listed items in the event of their loss or destruction. Effects are catalogued by their name, description and value. Nine separate rooms are provided, and up to 28 items may be listed in each.
Cat. XE-7000 ....**$15.95**

BASIC TUTORIAL
Is a super teaching aid for any classroom. Basic Tutorial is a set of 9 interactive exercises designed for teaching Basic to the computer novice. No previous knowledge is assumed. Basic Tutorial uses a unique double screen technique to display both the normal computer output and the tutorial exercises at the one time. This allows the student to use the MicroBee in the normal way, while the tutorial instructions appear in the lower half of the screen.
Cat. XE-6860 .... **$22.00**

MACHINE CODE TUTORIAL - Mytek
Consists of 8 interactive exercises designed for teaching machine code programming and related topics as they apply to the MicroBee computer. Only a general knowledge of the BASIC language is assumed. Machine Code Tutorial is designed to bridge the gap between BASIC programming and being able to understand and use typical Z80 manuals.
Cat. XE-6855 .... **$27.50**

DATABEE
This program is a well written data base management system that utilised the MicroBee to its fullest to provide a Data Management System similar to those found on larger and more expensive systems. This comes complete with large bound manual.
Cat. XE-6945 ....**$19.95**

ATTENTION:
MICROBEE USERS
● GOOD ORIGINAL SOFTWARE WRITERS REQUIRED
● TOP MONEY PAID FOR ORIGINAL PROGRAMS

If you are a creative programmer who believes that your programs will sell why not write for us? Maybe you can turn your hobby into a profitable business.
We insist on glitch-free programs with reasonable written instructions.
Jaycar will pay you either a once-only fee or a commission on the sale of the programs.
Either way you will do better with us. We will mass produce all material and you can audit us on sales any time.
If you think that you have a program that is exciting, unique or simply better than what's around - why not contact us?
Just send a quality recording of the cassette, (yes, you CAN trust us) for us to evaluate.

TOP PRICES PAID FOR GOOD PROGRAMS

NEW!

ETI 675 MICROBEE
Parallel-to-serial interface

Ref: ETI January 1984
Great kit enables you to convert the serial (almost RS-232) port on your MicroBee to a parallel port suitable for the cheap parallel printers now around.
Cat. KE-4665

ONLY $29.50
BASIC KIT

NEW!

ETI 656 BUG DEBUGGER

Ref: ETI January 1984
What a great idea! This project enables you to analyse a programming bug in a EPROM. You can also use it for temporary program storage with battery backup. The Jaycar kit comes with all the ETI specified components.
Cat. KE-4655

ONLY $35.00

MICROSOFT BASIC-80 MANUAL
This book explains in detail the MicroSoft BASIC that comes with Disc Drive Systems. It includes information about Disc file loading and instructions on the use of assembly language routines.
Cat. XE-8018 ....**$29.95**

NEW SOFTWARE FOR FEBRUARY 1984

COMPOSER BEE II
This program allows you to write music straight onto the screen. You can then either edit, transpose, playback or save the notes onto cassette. This is a program which is educational and entertaining.
Cat. XE-7061 ....**$21.95**

DATA MANAGER
Data Manager can hold up to 200 records (32K) or 60 records (16K). Each record consists of 4 lines, a search can then be done on any word in any record and those records displayed.
Cat. XE-7062 ....**$15.95**

WILDCARDS II
This book is the sequel to Wildcards Vol.1. It contains much, much more information and a memory map of 7 pages. If you liked the first volume you're going to love the sceond even more.
Cat. XE-8016 ....**$16.00**

EMU JAUST
Another excellent hi-res graphic game from Mytek. This is a game with added realism, excellent graphics and fantastic sound. Mytek have far surpassed themselves with this one.
Cat. XE-7058 .... **$22.00**

TAPE DOCTOR
A great utility program from Mytek. As well as being able to make backup tapes, it can load bad tapes and in doing so points out the errors in the tape. A very useful program.
Cat. XE-7059 ....**$18.50**

DEBUG
Another utility program from Mytek. It operates at assembler level and allows the entering of breakpoints into machine language programs. A very useful utility to use.
Cat. XE-7060 ....**$18.50**

Jaycar Incorporating
ELECTRONIC AGENCIES

SYDNEY SHOWROOMS
117 YORK STREET – PHONE: (02) 264 6688 and (02) 267 1614
TELEX: 72293
CARLINGFORD
Cnr. CARLINGFORD & PENNANT HILLS ROAD – PHONE: (02) 872 4444
CONCORD
115 – 117 PARRAMATTA ROAD - PHONE: (02) 745 3077
HURSTVILLE 121 FOREST ROAD - PHONE: (02) 570 7000

NUMBER 1 FOR KITS

POST AND PACKING CHARGES
$5 – $9.99 ($1.50) $10 – $24.99 ($3.20)
$25 – $49.99 ($4.50) $50 – $99.99 ($6.50)
$100 – $198 ($8.00) Over $199 ($10)
"Free INSURANCE for Road & Registered Post over $200"
All heavy or bulky items (over 20kg.) sent Comet Road Freight $12.00 anywhere in Australia.
SHOP HOURS CARLINGFORD, CONCORD & HURSTVILLE
Mon – Fri 9am – 5.30pm: Sat – 9am – 12pm: Thurs night 8.30pm
SHOP HOURS SYDNEY
Mon – Fri 8.30am – 5,30pm. Sat – 8.30am – 12pm: Thurs night 8.30pm
MAIL ORDERS AND CORRESPONDENCE: P.O. Box 185, Concord, 2137

Mail Order By
BANKCARD
Via Your Phone

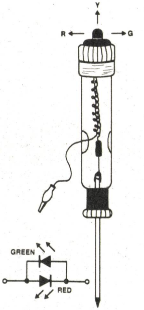
CHECK OUR CONCORD STORE FOR SATURDAY AFTERNOON TRADING IN FEBRUARY

These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we cannot enter into any correspondence about any of the circuits, nor can we produce constructional details.

Polarity indicator

This polarity indicator, designed by **Malcolm Fields** of **Kangaroo Flat Victoria**, is for low voltage solid state work with 6, 9 or 12 V dc supplies.

The heart of the device is a simple Radio Shack tri-colour LED (276-035); very easy to see how it works, however, the sneaky bit is that with an ac current the red/green gives a yellow glow — a bonus which appealed to me. The other devices I had contemplated buying were either terribly expensive or unimaginative with two LEDs being used or great extensions I wouldn't dream of poking any instruments into.



I wanted something rugged, comfortable, safe, attractive and useful. I decided to use an ordinary 240 V neon mains tester/screwdriver as the carrier/probe for the tester. Ellistronics has one which has an amber body and plastic sheaf along the screwdriver shaft, topped with a neat red plastic cap and contact.

I emptied out the neon tube and spring and drilled out the contact hole in the cap to take the body of the tri-colour LED (used a bit of epoxy). I used a 390R resistor as the brilliance it provides is adequate and should suit most applications.

I drilled a neat 3 mm hole in the middle of the optical viewing lens in the plastic body and carried a light, black hook-up wire out to a black plastic mini-clip and into the short leg of the LED. Getting the internal contact from the LED through the resistor to the blade is tricky. I used a piece of copper tubing about 3 mm in diameter and 5 mm long and soldered (and crimped) the positive lead to it before forcing it on to the end of the shaft which protrudes about 4 mm into the neon compartment.

I used light wiring internally and sleeved all connections before giving the whole wiring about eight reverse twists which allowed me to screw the cap on nicely. The internal wiring has to be about 7-8 cm long to allow for twisting.

Electric floor heat earth leakage monitor

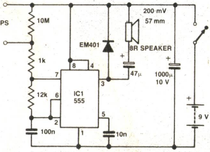
This circuit may look familiar to some since it's very similar to the warbling alarm in Ideas for Experimenters, ETI March 1980, wrote **Alec Phillips** of **Myrtleford Victoria**.

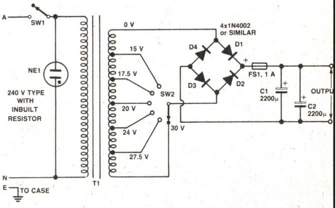
I made it in response to a request from an electrician friend of mine, who needed an audible monitor connected to electric floor heat coils while cement was being poured. One clip is connected to the outer earth casing and the other clip is connected to the centre element.

The circuit is basic and self explanatory. I mounted it in a Clipsal 265/3 PVC box, 102 mm x 102 mm x 70 mm, and used a 200 mW, 57 mm, 8R speaker and a 9 V battery.

Normally the unit just ticks at about 1 kHz but if the heating coil is damaged by a shovel or a cement vibrator, the frequency suddenly increases to approximately 400 Hz, depending on the amount of resistance in the short circuit. Also, any small leakage of ten milliohms or less, will naturally increase the frequency of the output a small, but notable amount.

A special note: this will not do away with the final testing with a high voltage megger after the cement pour is completed, but it has proved very useful during a pour.





Simple variable power supply

David Tindall of **Doncaster Victoria**, 15 years old, designed this simple circuit which he has found very useful.

I think it will appeal to beginners and enthusiasts of my own age.

SW1 is an on/off switch and NE1 is used to indicate what state the power supply is in. T1 steps down the 240 V to six different voltages. Each 'tap' on the transformer (except 0 V) is connected to SW2. SW2 selects one of the six voltages.

The rectifier bridge is made up of four 1N4002 diodes (or similar). Capacitors C1 and C2 are provided to filter the ac ripple which is present. The fuse should be no more than 1 A when the transformer I used is overloaded it has a nasty habit of becoming very hot.

ALL ELECTRONIC COMPONENTS

That's our name . . . that's our game!!!

MAJOR STOCKISTS OF ALL GENERAL RADIO AND ELECTRONIC COMPONENTS

ETI AND EA KITSET SPECIALISTS (LARGEST RANGE IN AUSTRALIA) — TOP QUALITY, LOW PRICES

LEARN WHILE YOU BUILD

STEREO UNITS
S1 ETI 484 Compressor Expander
S2 ETI 482 50 watt per channel Amplifier
S3 ETI 482A Preamp Board
S4 ETI 482B Tone Control Board
S5 ETI 485 Graphic Equalizer
S6 ETI 480 50 watt Amplifier less H/S & bracket
S7 ETI 480 100 watt Amplifier less H/S & bracket
S8 ETI 480 Power Supply for above
S9 ETI 443 Expander Compressor
S11 ETI 458 Audio Level Meter
S12 ETI 438 Audio Level Meter
S17 ETI 422 50 watt per channel Amplifier*
S18 ETI 426 Rumble Filter
S19 ETI 429 Simple Stereo Amplifier
S21 ETI 417 Over LED Distortion Monitor
S31 EA Musi Colour 4 1000 w/ch
S33 E.A. Musicolour III 1000 w/ch
S34 E.A. Stereo Dynamic Noise Filter
S35 ETI 470 60 watt audio amplifier module
S36 ETI 4000 Series 60 watt stereo amplifier
S37 ETI 451 Hum Filter for Hi-Fi systems
S38 E.A. Stereo Infrared Remote Switch
S39 ETI 455 Stereo Loudspeaker Protector
S40 E.A. Super-Bass Filter Less Power Pack
S42 E.A. Stylus Timer
S43 ETI Series 3000 Amplifier 25w/ch
S44 ETI 477 Mosfet power amp module inc. brackets
S45 ETI 457 Scratch/Rumble Filter
S48 ETI 5000 Power Amplifiers
549 ETI 494 Loudspeaker Protector
S50 EA Infared TV Sound Control
S51 HE 121 Scratch & Hiss Filter
S52 EA 100 watt Sub Woofer Module
S53 EA Stereo Simulator

PRE-AMPLIFIERS AND MIXERS
P1 ETI 445 Stereo Pre-Amplifier
P2 ETI 449 Balance Mic Pre-Amplifier
P6 ETI 419 Mixer Pre-amplifier — 4 ch.
Mixer Pre-amplifier — 2 ch.
P10 E.A. Playmaster 145 Mixer
P11 ETI 446 Audio Limiter
P12 ETI 471 High Performance Stereo Pre-amplifier
P13 ETI 477 Moving Coil Cartridge Pre-Amp
P14 ETI 474 High to low Impedence Interface
P15 ETI 467 4 Input Guitar/Mic. Pre-amp Suits
P16 EA Moving Coil Pre-Amp (Battery)
P17 EA Moving Coil Pre-Amp (Plug Pak)
P18 ETI 478mm Moving Magnet Pre-Amp (Series 5000)
P19 ETI 478mc Moving Coil Pre-Amp (Series 5000)
P20 ETI 478 Series 5000 Pre-Amp
P21 EA Vocal Cancellor
P22 ETI 461 Balanced Pre-Amp
P23 HE112 Micromixer
P24 EA Effects Unit
P25 EA Stereo Simulator

GUITAR UNITS
G1 ETI 447 Audio Phaser
G2 ETI 413 2 x 100 watt Bridge Amplifier
G5 ETI 413 100 watt Guitar Amplifier
G14 ETI 452 Guitar Practice Amplifier
G15 ETI 466 300 watt Amp module — less H/S & Transformer
G16 ETI 454 Fuzz-Sustain less foot switch
G17 HE 102 Guitar Phaser
G18 ETI 450A Bucket Brigade
G19 ETI 450B Mixer for above
G20 EA Guitar Pre-Amp
G21 Sonics ME2 Wah Wah Pedal — less pedal
G22 EA Effects Unit

Also Hobby Electronic Projects.

AUDIO TEST UNITS
AT1 ETI 441 Audio Noise Generator
AT2 ETI 128 Audio Millivolt Meter
AT7 ETI 137 Audio Oscillator
AT9 HE 105 Bench Amplifier (less case)
AT10 EA Audio Test Unit
AT11 EA Function Generator
AT12 ETI 464 Audio Test Units

POWER SUPPLIES
PS1 ETI 132 Experimenters Power Supply
PS2 ETI 581 Dual Power Supply (High Powered Version)
PS3 ETI 712 CB Power Supply
PS4 ETI 131 Power Supply
PS6 ETI 105 Laboratory Power Supply
PS7 ETI 111 I/C Power Supply
PS9 E.A. 1976 Regulated Power Supply
PS10 E.A. Dual 30-2 0-30V at 2A or 0-60V at 2A or Dual Pos and Neg 30V at 2A
PS11 E.A. C.B. Power Supply
PS12 ETI 142 Power Supply 0-30 V 0-15 A (fully protected)
PS13 ETI 472 Power Supply
PS15 ETI 577 Dual 12V supply
PS 18 Bench Mate Utility Amp Power Supply
PS 20 ETI 163 0-40V 0-5A

COMPUTER AND DIGITAL UNITS
C1 ETI 633 Video Synch Board*
C2 ETI 632M Part 1 Memory Board V.D.U.*
C3 ETI 632P Part 1 Power Supply V.D.U.*
C4 ETI 632A Part 2 Control Logic V.D.U.*
C5 ETI 632B Part 2 Control Logic V.D.U.*
C6 ETI 632C Part 2 Character Generator V.D.U.*
C8 ETI 632 U.A.R.T. Board*
C9 ETI 631-2 Keyboard Encoder*
C10 ETI 631 A/Sch. Keyboard (less keyboard)*
C11 ETI 660 Computer
C13 E.A. Cassette-Tape Interface
C14 ETI 638 Eprom Programmer
C15 ETI 637 Cuts Cassette Interface
C16 ETI 651 Binary to Hex Number Converter
C17 ETI 730 Getting Going On Radio Tele Type
C19 ETI 731 R.T.T.Y. Modulator
C24 ETI 760 Video RF Modulator
C25 EA Eprom Programmer
C26 ETI 668 Microbee Eprom Programmer
C27 ETI 733 Radio Teletype Computer Decoder
C28 EA Video Amp for Computers
C29 ETI 649 Microbee Light Pen (not incl. case)
*All V.D.U. projects priced less connectors

TEST EQUIPMENT
TE2 ETI 133 Phase Meter
TE3 ETI 533C Digital Display
TE4 ETI 129 R.F. Signal Generator
TE5 ETI 130 Temperature Meter
TE6 ETI 706 Marker Generator
TE8 ETI 122 Logic Tester
TE9 ETI 124 Tone Burst Generator
TE10 ETI 123 C Mos Tester
TE11 ETI 116 Impedance Meter
TE12 ETI 533 Digital Display
TE15 ETI 704 Cross Hatch Dot Generator
TE16 ETI 120 Logic Probe
TE17 ETI 121 Logic Pulser
TE20 ETI 157 Crystal Marker
TE34 ETI 487 Real Time Audio Analyser
TE35 ETI 483 Sound Level Meter
TE36 ETI 489 Real Time Audio Analyser
TE37 ETI 717 Cross Hatch Generator
TE38 E.A. 3 Mhz Frequency Counter
TE41 E.A. Function Generator
TE42 E.A. Transistor Tester incl. BiPolar & F.E.T.S.
TE43 ETI 591 Up Down Pre-setable Counter
TE44 ETI 550 Digital Dial (less case) includes ETI 591
TE45 ETI 144 Expanded Scale R:M.S. Voltmeter
TE46 ETI 148 Versatile Logic Probe
TE47 ETI 724 Microwave Oven Leak Detector
TE48 ETI 150 Simple Analog Frequency Meter
TE49 ETI 151 Linear Scale Ohm Meter
TE50 ETI 152 Linear Scale Capacitance Meter
TE51 E.A. Digital Capacitance Meter
TE52 ETI 589 Digital Temp. Meter
TE53 E.A. T.V. C.R.O. Adaptor less Power Pack
TE54 E.A. XTAL Locked Pattern Generator
TE55 E.A. Decade Resistance Sub Box
TE56 E.A. Capacitance Sub Box
TE57 E.A. Decade Capacitance Sub Box
TE58 E.A. Tantalum Capacitance Sub Box
TE59 ETI 140 1 GHZ Frequency Meter/Timer
TE60 ETI 572 PH Meter
TE61 ETI 135 Panel Meter
TE 61. EA TRANSISTOR TESTER

WARNING SYSTEMS
WS1 ETI 583 Gas Alarm
WS3 ETI 528 Home Burglar Alarm
WS4 ETI 702 Radar Intruder Alarm
WS7 ETI 313 Car Alarm
WS12 ETI 582 House Alarm
WS14 E.A. 1976 Car Alarm
WS15 E.A. 10 Ghz Radar Alarm
WS16 E.A. Light Beam Relay
WS17 ETI 247 Soil Moisture Indicator
WS 18 ETI 250 Simple House Alarm
WS 19 ETI 570 Infrared Trip Relay
WS 20 ETI 585 T & R Ultrasonic Switch
WS 21 ETI 330 Car Alarm
WS 22 ETI 322 Over Rev Car Alarm

AUTOMOTIVE UNITS
A1 ETI 317 Rev. Monitor
A3 ETI 316 Transistor Assisted Ignition
A4 ETI 240 High Power Emergency Flasher
A6 ETI 326 Expanded Scale Volt Meter
A14 E.A. Dwell Meter
A15 E.A. Variwiper
A16 E.A. Tacho for Tune-ups
A20 ETI 325 Auto Probe
A22 ETI 318 Digital Car Tachometer (less Metalwork)
A23 ETI 319A Variwiper Mk. 2 (no dynamic braking)
A24 ETI 319B Variwiper Mk. 2 (for dynamic braking)
A25 ETI 555 Light Activated Tacho
A26 ETI 320 Battery Condition Indicator
A27 E.A. Transistor Assisted Ignition
A28 ETI 324 Twin Range Tacho less case
A29 ETI 328 LED Oil Temp Meter less V.D.O. probe
A30 ETI 321 Auto Fuel Level Alarm
A31 ETI 332 Stethoscope
A32 ETI 325 Auto Probe
A33 ETI 333 Reversing Alarm
A34 EA Low Fuel Indicator
A35 ETI 326 Led Expanded Voltmeter
A36 ETI 329 Ammeter (Expanded Scale)
A37 ETI 327 Turn & Hazard Indicator
A38 ETI 159 Expanded Scale Voltmeter
A39 EA Optoelectronic Ignition
A40 ETI 335 Wiper Controller

PHOTOGRAPHIC
PH1 ETI 586 Shutter Speed Timer
PH3 ETI 514B Sound Light Flash Trigger
PH4 ETI 532 Photo Timer
PH7 ETI 513 Tape Slide Synchronizer
PH10 ETI 540 Universal Timer
PH12 E.A. Sync-a-Slide
PH14 ETI 558 Mast Head Strobe
PH15 ETI 553 Tape Slide Synchronizer
PH16 E.A. Digital Photo Timer
PH17 ETI 594 Development Timer
PH18 ETI 568 Sound or light operated Flash Trigger inc. optional parts

RECEIVERS/TRANSMITTERS
R1 ETI 711 Remote Control Transmitter Switch
R2 ETI 711R Remote Control Receiver
R3 ETI 711D Remote Control Decoder
R4 ETI 711B Single Control
R5 ETI 711C Double Control
R6 ETI 711P Power Supply
R7 ETI 707A 144 Mhz Converter
R8 ETI 707B 52 Mhz Converter
R9 ETI 708 Active Antenna
R11 ETI 780 Novice Transmitter
R12 ETI 703 Antenna Matching Unit
R31 E.A. 27 Mhz Pre-amp
R32 E.A. 10-30 Mhz Pre-amp
R33 ETI 718 Shortwave Radio
R34 ETI 490 Audio Compressor
R35 ETI 721 Aircraft Band Converter (less XTALS)
R37 ETI 475 Wide Band A.M. Tuner

VOLTAGE/CURRENT CONTROLS
V1 ETI 481 12 volt to - 40V D.C. 100 watt Inverter
V2 ETI 525 Drill Speed Controller
V6 E.A. 1976 Speed Control
V7 ETI 592 Light Show Controller (3 ch.) (1000 w/ch)
V8 E.A. Inverter 12V D/C input 230V 50hz 300VA output
V9 ETI 593 Colour Sequencer (for use with ETI 592)
V12 ETI 1505 Fluorescent light inverter
V13 EA Electric Fence
V14 ETI 1506 Xenon Push Bike Flasher
V15 ETI 1509 AC-DC Inverter
V16 ETI 1512 Electric Fence Tester
V17 EA Fluro Light Starter

MISCELLANEOUS KITS
M1 ETI 604 Accentuated Beat Metronome
M2 ETI 546 G.S.R. Monitor (less probes)
M3 ETI 549 Induction Balance Metal Detector includes wire for search head
M4 ETI 547 Telephone Bell Extender
M5 ETI 602 Mini Organ (less case)
M6 ETI 544 Heart Rate Monitor
M10 ETI 539 Touch Switch
M22 ETI 256 Humidity Sensor
M23 E.A. Electronic Roulette Wheel
M25 E.A. Digital Metronome
M26 E.A. Voice Operated Relay
M29 E.A. Sound Effects Generator
M30 ETI 551 Light Chaser 3 channel 1000 watt/ch
M32 E.A. Remote TV Headphone
M34 ETI 650 STAC Timer
M40 E.A. Mast Head Amplifier
M41 ETI 576 Electromyogram
M42 E.A. Prospector Metal Locator including headphone
M43 ETI 561 Metal Locator less dowel and tubing potplant stand
M44 E.A. Musical Tone Generator
M45 E.A. Light Chaser 3 channel
M49 E.A. Selectalott
M50 ETI 1500 Discriminating Metal Locator
M51 E.A. Light Chaser
M52 E.A. Cylon Voice
M53 E.A. Universal Timer Stop Watch
M53 ETI 566 Deep Seeking Meal Locator
M55 ETI 562 Geiger Counter
M56 ETI 607 Sound Effects
M57 ETI 257 Universal Relay Driver Board
M58 EA Simple Metronome
M59 ETI 1501 Neg Ion Generator
M60 ETI 1516 Sure Start for Model Planes
M61 ETI 412 Peak Level Display
M62 ETI 1515 Motor Speed Controller
M63 ETI 1520 Wideband Amplifier
M64 EA Masthead Pre-Amp
M65 ETI 735 UHF to VHF TV Converter
M66 HE 104 AM Tuner
M67 HE 106 Radio Microphone
M69 ETI 733 Radio Teletype Converter for Microbee
M70 ETI 1517 Video Distribution Amp
M70 ETI 499 150 watt Mosfet P.A. Module
M71 ETI 498 499 150 watt P.A. Amplifier.

ALL ELECTRONIC COMPONENTS

118 LONSDALE STREET, MELBOURNE, VIC. 3000. TEL. 662 3506.

Charging nickel-cadmium cells

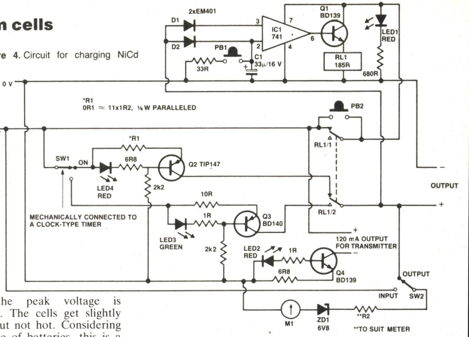


Figure 4. Circuit for charging NiCd cells.

T. J. Threlfall of **West Perth, WA** designed this circuit to prevent accidental overcharge of nickel-cadmium cells when using a really fast charge.

I'm interested in racing 1/12th scale electric radio-controlled model cars. These cars use 6x 1.0 Ah cells and will run for ten minutes or so at an average current drain of 5-6 A. The usual method of recharging is via a 0.5 ohm resistive lead set from a 12 V car battery, average 4 A, for 15 minutes if it is initially fully discharged. A good working rule is 1.5 minutes charge for every one minute running time.

But accidents can happen and even using a timed charger does not prevent disasters as the period can be set for too long a time.

A General Electric handbook on its range of rechargeable batteries shows voltage/time curves for constant-current charging at various rates.

Figure 1 shows the general form of these curves. A curve plotted for my specific situation is shown in Figure 2. In both cases the cell voltage is shown to reach a peak soon after the cell is fully charged, and then cell voltage decreases.

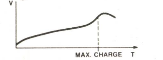


Figure 1. General form of voltage/time curve for NiCd cells, constant current charging.

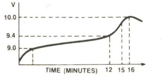


Figure 2. Voltage/time curve charging 6x1.0 Ah NiCd cells at 4 A.

A crude peak detector of the type shown in Figure 3 can be used to turn off a charger soon after the peak voltage is reached. The cells get slightly warm but not hot. Considering the price of batteries, this is a cheap way of doing it.

PB1 discharges C1 to enable the 741 to set, turning on Q1 and the relay when PB2 is depressed. PB1 and PB2 are momentary 'push-to-make' switches. Box A contains either resistive lead or any other current limiting device. C1 is a tantalum low-leakage capacitor. The diodes should be chosen so that the circuit is stable when the relay is on.

To test the circuit disconnect point B from the relay contact, connect B to a potentiometer between the +12 V and 0 V rails to see what voltage change is needed to switch off the relay.

The entire circuit shown in Figure 4 may be more relevant to a radio-controlled model, but the switching section should be of interest to those people who built the ETI-563 charger.

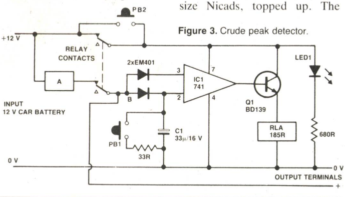


Figure 3. Crude peak detector.

How it works

The charger has two outputs. An unswitched 120 mA constant current output through Q4 is for keeping a radio-controlled transmitter, fitted with 8 AA size Nicads, topped up. The associated red LED indicates current is flowing through the leads (it will still light on a short circuit).

The second pair of output terminals supplies either 4 A (timer and relay on), 115 mA (timer and relay off) or nothing (relay off but timer still on). Q2, for the 4 A supply, is a high-gain PNP transistor. This was used to avoid the extra voltage drop of a Darlington pair which would restrict the output capability when the load of six sub-C size Nicads rises to about 10.5 V.

LEDs in the base leads of Q2 and Q3 indicate current flow in the output leads. Red indicates high current is flowing through the load, green shows a slow charging of the load, while neither LED alight indicates the protection circuit IC1 has switched the relay off while the timer is still on.

The timer used is a 0-60 minute clock-type kitchen timer connected mechanically to a 10 A SPDT microswitch with an extended paddle (as the timer was not strong enough to pull the switch reliably with the standard paddle length).

In operation, when the 12 V supply battery and the load are plugged in the green LED should light. When the timer is set for the approximate charge time required the green LED should go out.

PB2 is depressed, bypassing contacts RL1/1 and supplying power to the protection circuit. PB1 is depressed while PB2 is held down, draining C1. The relay should click on and the red LED4 should light. When PB1 and PB2 are released bot LED1 and LED4 shoul remain on.

Meter M1 is a cheap signa meter prescaled with ZD1 an R2 to read in the range 7-12 fairly accurately. SW2 allow the state of the 12 V suppl battery to be checked with o without a load, and monitor the voltage rise of the loa battery.

If the timer is set for too lon a period, the voltage at th output terminals will reach peak and then begin to fall (se Figures 1, 2). As the voltag falls pin 2 of IC1 will remai high. The voltage on pin 3 wil drop which will cause the outpu on pin 6 to go low and turn of Q1 and the relay. The loa batteries will drain back throug the supply at 5-6 mA until th timer runs out. This is possibl of some benefit as the cells ar *slightly* overcharged by the tim the relay has turned off.

The emitter-resistor of Q2 consisting of 11 x 1.2 ohn resistors, is slightly bulky an could be substituted by a piec of thin hookup wire if it ca handle the current.

The current output of thi section of the circuit is no constant, varying from 5 A int a completely-discharged load t 2.5 A when the load voltag reaches its peak of abou 10.5 V. As this represents total voltage drop in the charge of only 1 V, it *is* important tha this is not increased by substituting a Darlington pai for Q2. (The car battery use dropped to about 11.5 V at 4 A after a little use).

THE METER BY WHICH ALL OTHERS ARE MEASURED

The 3212 is simply designed so it's easy to use and gives absolute maximum performance at a reasonable price.

It has a high current measurement capacity (AC.DC 10A), overvoltage protection to AC250V in both current (except 10A) and Ohms ranges and it is Autoranging (except current).

It also has Lo Ohms for in-circuit resistance measurements and continuity test results are reported by an audible tone.

The Hioki 3212 is a no-nonsense, down to earth meter with all the features you need to do the job.

And do it well.

Special introductory price **$82.** Normally $96.

Specifications

Display: 3 1/2-digit LCD, maximum reading of "1999", autopolarity, unit and other annunciators.

Ranging: Auto (manual ranging in current ranges).

Overrange Indicator: "1" in MSD column blinks, audible tone (No audible tone for Ohms; no indicator or buzzer for DC 1000V, AC 600V.).

Battery Low Indicator: BATT mark lights.

Sampling Rate: 2 per second.

Environmental Conditions (Operating): 0 ~ 40°C, < 80% RH. (No condensation)

Maximum Allowable Input: Volts; DC 1000V max. AC 750V max. Ω/A: AC 250V max.

Dielectric Strength: AC 3000V/1 min.

Power Source: Two size AA (SUM-3) batteries; Battery current, 5mW.

Dimensions: 160H x 85W x 30D (mm).

9145 carrying case supplied.
Option: 9014 HV Probe.

Measurement Range and Accuracy
(Specified for 23°C ± 5°C. < 80% RH)

	Range	Resolution	Accuracy	Notes
DCV	200mV	100µV	±0.5%rdg ± 4dgt	Input resistance 100MΩ
	2V	1mV	±0.7%rdg ± 4dgt	" 10MΩ(approx.)
	20V	10mV	"	" "
	200V	0.1V	"	" "
	1000V	1V	±1.0%rdg ± 4dgt.	" "
ACV	2V	1mV	±1.0%rdg ± 8dgt	Input resistance approx 10MΩ (approx.) (40Hz to 500Hz)
	20V	10mV	"	" "
	200V	0.1V	"	" "
	600V	1V	±1.2%rdg ± 8dgt.	" "
DCA	200mA	100µA	±1.5%rdg ± 4dgt.	approx 1Ω (not including fuse resistance)
	10A	10mA	±1.7%rdg ± 4dgt.	approx. 15mΩ >
ACA	200mA	100µA	±2.0%rdg ± 8dgt.	1Ω 40Hz ~ 500Hz
	10A	10mA	±2.2%rdg ± 8dgt.	approx. 15mΩ >
OHMS	200Ω	0.1Ω	±0.8%rdg ± 5dgt.	Open-terminal voltage 1.5V ± 0.2V
	2kΩ	1Ω	"	0.65V ± 0.065V "
	20kΩ	10Ω	"	" "
	200kΩ	100Ω	"	" "
	2000kΩ	1kΩ	±1.8%rdg ± 10dgt.	" "
LPΩ	2kΩ	1Ω	±1.0%rdg ± 10dgt.	Open-terminal voltage < 0.4V
	20kΩ	10Ω	"	" "
	200kΩ	100kΩ	"	" "
	2000kΩ	1kΩ	±2.0%rdg ± 10dgt.	" "

*Plus Sales Tax.

HIOKI

NILSEN ROWE

Registered office: 200 Berkeley St.,
Carlton, Vic, 3053.

For further information about Hioki multimeters or to order a Hioki 3212 multimeter, fill in this coupon.
Send it to Nilsen Rowe Australia Pty. Ltd., P.O. Box 349, North Melbourne, Vic. 3051.

Please send me further information ☐ a Hioki 3212 multimeter ☐

Name________________ Address________________

________________ Postcode________

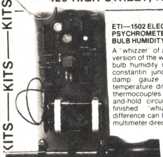
I enclose cheque/postal note for $82 or debit my Bankcard account number. ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ Cardholder's signature________________ Expiry date ___/___/___

HEFK/NIL/1405/R

KIT SPECIALISTS

ROD IRVING ELECTRONICS

425 HIGH STREET, NORTHCOTE 3070, MELBOURNE, VICTORIA. Ph (03) 489 8131. Telex No. 38897



ETI—1502 ELECTRONIC "SLING PSYCHROMETER"—WET BULB/DRY BULB HUMIDITY METER

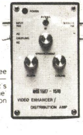
A "whizzer" of a project. It's an electronic version of the weather man's wet bulb/dry bulb humidity meter. Uses two copper-constantin junctions, one 'wetted' with damp gauze or cotton wool. The temperature difference between the two thermocouples is measured by a sample-and-hold circuit so that, when you've finished "whizzing" the temperature difference can be measured with a digital multimeter directly from the volts scale.

P.O.A.

ETI—1518 VIDEO ENHANCER

This simple to build project features three controls for curing video "image ills"—**floor, ceiling** and **enhancement.** It's designed to be installed either 'stand alone' or in with the ETI—1517 Video Distribution Amplifier.

$25.00



P.O.A.

ETI 674 MICROBEE PROPORTIONAL JOYSTICK CONTROLLER

Oh the joy of a 'proper' joystick! Most computer joysticks are of the switch type. But, when you want to get into some 'real' joystick action, nothing beats a proportional joystick with potentiometers. This straightforward project for the Microbee, in our continuing popular series, simply plugs into the Bee's parallel port.

ETI-268 NICAD FLOAT CHARGER

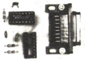
$9.00 ETI MARCH '83

Keep your NiCad batteries in tip-top condition with this cheap, simple charger.

$18.50 ETI Oct 83

ETI-412 PEAK PROGRAMME METER

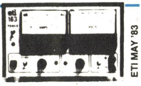
This project uses a 10-LED bargraph display module to show audio level from −23 dB to +6 dB. It's simple to build and set up.



ETI Oct 83 **$16.50**

ETI-672 MICROBEE TELETYPE INTERFACE

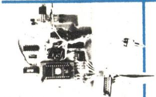
The "Claytons" of printers is the old surplus teletype—such as the Model 15 etc. For around a tenth the price of a dot-matrix printer, you can have hard copy from your microbee using this simple interface.



ETI MAY '83

ETI-163 LAB SUPPLY **$159**

Fully variable 0–40 V current limited 0–5 A supply with both voltage and current metering (two ranges: 0–0.5 A 0–5 A). This employs a conventional series-pass regulator, not a switchmode type, with its attendant problems, but dissipation is reduced by a unique relay switching system switching between taps on the transformer secondary



ETI-668 MICROBEE EPROM PROGRAMMER **$47.50**

ETI FEB '83

Simple, low cost programmer for the MicroBee can program 2716s, 2732s and 2764s.

ETI-153 TEMP. PROBE

$19.95

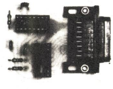
ETI JUNE '83

Can measure temperature from −50°C to +150°C. It simply plugs into your multimeter—great for digital multimeters. Accuracy of 0.1°C, resolution of 0.1°C.

ETI MAY '83

ETI-323 HEADLIGHT DELAY UNIT **$17.50**

Park your car and turn off the lights. Can't see where you're going? Press the button and the headlights come on to light your way, switching off automatically after 50 seconds. This is a simple, easy to build, low cost project.



$12.50 ETI Oct 83

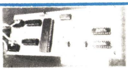
ETI-671 MICROBEE PRINTER INTERFACE

A simple interface unit for parallel printers.

ETI-162 30 V/1 A FULLY PROTECTED POWER SUPPLY

ETI DEC '83 **$47.50**

The last power supply we did was the phenomenally popular ETI-131. This low cost supply features full protection, output variation from 0 V to 30 V and selectable current limit. Both voltage and current metering is provided.



ETI-654 APPLE II ANALOGUE/DIGITAL INTERFACE

$159.00 ETI MARCH '83

This project will give your Apple a set of 8-bit digital inputs and outputs plus one analogue input and one analogue output. Applications include: driving a robot, recording science experiment results, etc. (digital only shown).

ETI-688 BIPOLAR PROM PROGRAMMER

$47.50 ETI JUNE '83

Every digital workshop should have one! Can be used to program the popular fusible-link PROMs like the 74S188 288, 82S23 and 82S123 etc.

ETI-461 GENERAL PURPOSE BALANCED INPUT PREAMP **$20.00**

ETI Oct '82

This project can be used as a balanced mic amp, with low impedance input, a low or high impedance input differential amplifier or a balanced input instrumentation amplifier.

ETI Oct 83 **$475 inc. tax**

ETI-690 LITTLE BIG BOARD

Just what you've always wanted in a computer—a big computer on a little board! This design runs a Z80A at 4 MHz, comes with 64K RAM, two RS232 ports and a floppy disk controller. It will run CP/M 2.2 and the board fits the soon-to-be-popular STD buss.

$75.00

ETI Oct 83

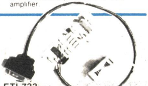
ETI-175 20 MHz HANDHELD FREQUENCY METER

A portable 4½-digit frequency meter that also measures period from 200 us to 200 ms. What's more, it looks so good, nobody will believe you built it yourself.

ETI-335 PUSHBUTTON-PROGRAMMABLE WIPER CONTROLLER

$28.50 ETI MARCH '83

No more fiddling with knobs and not getting the delay between wipes that you want—this windscreen wiper controller is simply programmed with two pushbuttons to provide the wiping delay you need.



ETI-733 RADIOTELETYPE CONVERTER FOR THE MICROBEE **$20.00**

ETI APRIL '83

Have your computer print the latest news from the internation shortwave news service. Just hook up this project between your shortwave receiver's audio output and the MicroBee's parallel port. A simple bit of software does the decoding. Can be hooked up to other computers too.

STOP FUTURE SHOCK

The Hioki 3200 digital multimeter has a large Bussman 600V HRC fuse built into it.

This way, if you make the wrong manual range selection when measuring on high energy power systems, you won't be seriously injured.

Normal multimeters can't offer this full over voltage protection up to AC 600V (Ω, μA, mA ranges).

And the HRC fuse is only one of a whole range of safety features offered by the Hioki 3200.

It's been shock-tested to withstand drops onto concrete of up to one metre.

The internal circuitry has been sealed against dust entry. A neon lamp indicator warns over voltage in ohms and ➔+ ranges.

The safety collar terminals and safety test leads provide maximum protection against electrical shock.

All the controls and terminals have been positioned according to research in human engineering, therefore minimizing any chance for operator error.

So while all these features may come as a surprise, they certainly won't shock you, now or in the future.

Special introductory price **$119.** Normally $141. *Plus Sales Tax

Measurement Range and Accuracy (specified for 23°C ± 5°C. <80% R.H. after zero adjustment.)

	Range	Resolution	Accuracy	Notes
DCV	200 mV	100μV	±0.35% rdg ±1 dgt.	Input resistance >1000MΩ
	2 V	1mV	±0.5% rdg ±1 dgt.	" approx 12MΩ
	20 V	10mV	"	" approx. 11MΩ
	200 V	0.1 V		"
	1000 V	1 V	±1.0% rdg ±1 dgt.	"
ACV	2 V	1mV	±1.0% rdg ±4 dgt.	approx Ω40Hz – 500Hz
			±2.0% rdg ±4 dgt.	" 500Hz – 1kHz
	20 V	10mV	±1.0% rdg ±4 dgt.	approx. 11MΩ 40Hz – 1kHz
			±2.0% rdg ±4 dgt.	1kHz – 5kHz
	200 V	0.1 V	±1.0% rdg ±4 dgt.	40Hz – 1kHz
			±2.0% rdg ±4 dgt.	1kHz – 5kHz
	750 V	1 V	±1.0% rdg ±4 dgt.	40Hz – 500Hz
			±2.0% rdg ±4 dgt.	500Hz – 1kHz
OHMS	200 Ω	0.1Ω	±0.7% rdg ±2 dgt.	Open terminal voltage 0.45V >
	2 kΩ	1Ω		
	20 kΩ	10Ω		

	Range	Resolution	Accuracy	Notes
OHMS	200 kΩ	100Ω	±0.7%rdg ±2dgt.	Open terminal voltage 0.45V >
	2000 kΩ	1kΩ	±1.0% rdg ±2 dgt.	"
	20 MΩ	10kΩ	±2.0% rdg ± dgt.	"
DCA	20 μA	10nA	±1.0%rdg ±1dgt	Int. resistance approx 10kΩ
	200 μA	100nA	"	" 1kΩ
	20 mA	10μA	"	" 10Ω
	200 mA	100μA	"	" 1Ω
	10 A	10mA	±1.2%rdg ±1dgt	" <15mΩ
ACA	20 μA	10nA	±1.5%rdg ±4dgt	" approx. 10kΩ 40 – 500Hz
	200 μA	100nA	±1.2%rdg ±4 dgt.	" ±1kΩ 40 – 1kHz
	20 mA	10μA		" 10Ω
	200 mA	100μA		" 1Ω
	10 A	10mA	±1.5%rdg ±4 dgt	<15mΩ 40 – 500Hz

Models:

Protected up to AC 250V.: 3200, 3200-01 (With carrying case)
Protected up to AC 600V: 3200-50, 3200-51 (With carrying case)

General Specifications
Display: 3½ digit LCD, maximum reading of "1999", autopolarity, unit and other annunciators.
Ranging: Auto and manual
Overrange Indicator: "1" in MSD column blinks, audible tone (No tone for Ohms: no indicator or audible tone for DC 1000V, AC 750V, 10A.)
Battery Low Indicator: BATT mark lights.
Sampling Rate: 2 per second.
Continuity Test & Diode Test
Environmental Conditions (Operating: 0-40°C <80 RH (No condensation)

Maximum Allowable Input: Volts DC1100V or DC + AC peak. Ω μA mA Cnty. ➔+. AC 600V max. 1A fuse: 10A range No protection.
Power Source: Two size AA (SUM-3) batteries. Life: 500 hours (continuous use)
Dimensions: 160H × 85W × 32.5D (mm), 310g
Accessories: Test Leads, Fuse: 3200-50: 0.5A, 1A 9145 Carrying case supplied.
Option: 9038 HV probe

HIOKI
NILSEN ROWE

Registered office: 200 Berkeley St.,
Carlton, Vic, 3053.

For further information about Hioki multimeters or to order a Hioki 3200 digital multimeter, fill in this coupon.
Send it to Nilsen Rowe Australia Pty. Ltd., P.O. Box 349, North Melbourne, Vic. 3051.

Please send me further information ☐ a Hioki 3200 digital multimeter ☐

Name

Address

Postcode

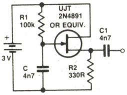
I enclose cheque/postal note for $119 or debit my Bankcard account number.

Cardholder's signature

Expiry date / /

HEFK/NIL/1406/R

Compact UJT signal injecter



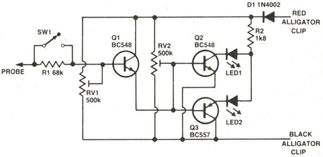
Have you ever needed a compact signal injector for those little 'away from home' jobs? This simple circuit, designed by **N. J. Espie** of **Chermside Qld** is powered by hearing aid batteries and will fit into a pen very nicely.

It can be used to test audio amplifiers, medium and shortwave receivers, and will even generate horizontal bars on a TV set if connected across the antenna terminals.

On powering up, capacitor C charges through resistor R1 until the UJT becomes forward biased. The UJT will then provide a discharge path for C via its emitter and resistor R2, resulting in C discharging rapidly until the transistor is no longer forward biased. Once this occurs, capacitor C will again begin to charge up via R1 and so complete one cycle of oscillation.

The rapid discharging of the capacitor through the UJT provides a sharp pulse, rich in harmonics, suitable for outputing via a decoupling capacitor C1 to the probe tip.

For a stronger signal, earth the signal injector to the system under test using an alligator clip.



Logic probe

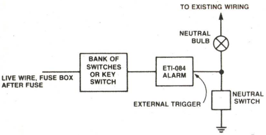
This simple circuit was designed by **Barry Drake** of **Scarborough Qld**.

Connect the circuit to a power supply and set RV1 to about half way. Slowly turn RV2 so that the 'high' LED glows and then slightly turn it back until the 'low' LED glows. Now adjust RV1 until both LEDs come on.

If the probe goes high, Q1 and Q2 conduct and the 'high' LED goes on. If the probe goes low, Q3 conducts and the 'low' LED goes on.

SW1 and R1 were included for voltages greater than one volt.

Motorcycle alarm



A. Glover of **Cootamundra NSW** has modified the car alarm project, ETI-084, to suit a motorcycle.

The external trigger is connected to the neutral wire (green and red on a Honda 250). Not only does the neutral switch activate the alarm, but all the other switches as well because the neutral indicator bulb connects the ignition wire.

To set the alarm the ignition must be off, the bike must be in gear, and all lights and indicators must be off. The kill switch must be off also because the external trigger will earth via the coils, and the points, if they are closed. Switch on the hidden switch or key switch. Operate any switch and the alarm will trigger.

Use a separate horn hidden somewhere, but be sure the alarm can handle the horn current. A miniature horn is easy to conceal and draws little current, but check anyway.

The circuit has been fitted for a year and although nobody has tried to take the bike, I have trapped myself a few times, mainly because I have not used the indicating LED. The reason for this, is that a thief may realise the bike has an alarm and look for a way of disconnecting it. The positions of horn, alarm and switches have been omitted for obvious reasons. All alarm parts were glued to the board to avoid vibration damage.

Audio turn signal indicator

Todd Gorman of **Swan View WA** found the flasher unit of his car to be barely audible, especially when the radio was on, so he designed this circuit to suit an XL Charger. However, he points out that the wiring around other flashing units may be different.

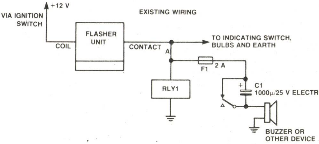
The flasher unit remains on but not earthed until the switch selects the bulbs, which are earthed, providing the pulsing action. It was not practical to connect the buzzer directly from point A as it would sound all the time while driving, and the switch/bulb wiring was too far up in the instrument panel.

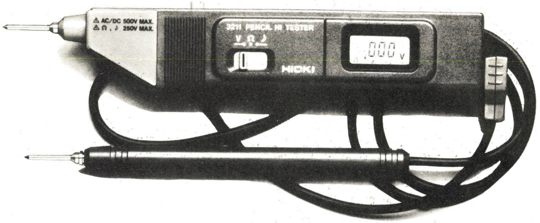
The relay will pull in when the ignition is switched on and the capacitor will discharge momentarily sounding the buzzer and then ceasing. When the indicating switch is selected, the relay will click on and off in conjunction with the flasher. C1 will discharge, sounding the buzzer quickly. It then stops while C1 charges up again.

When the indicators stop, the capacitor once more discharges and the buzzer fades until switched on again. The 2 A fuse protects the contacts but if a larger relay was used the fuse could be left out. An on/off switch could be fitted at point A or the negative terminal of C1.

The entire unit was small enough to be housed in a Strepsil tin and placed behind the dash on a small ledge.

If it goes off when i shouldn't, it indicates faulty wiring or an incorrect earth.





CURRENT TECHNOLOGY

This is the sensational new Hioki 3211 Pen – DMM, a technological breakthrough in digital multimeters.

Designed to be held in one hand like a large pen, it is extremely useful for trouble shooting and maintenance work on computer systems and other microcircuits.

The controls and display panel have been positioned according to results from research into human engineering.

The Hioki 3211 Pen – DMM even has a display hold function. This way, you can take readings after the meter has been removed from a point that's difficult to reach.

But you won't really know how good it is until you give it a try.

Special introductory price **$78.**

Normally $92. *Plus Sales Tax.

Specifications

Display: 3 ½-digit, maximum reading of "1999", autopolarity, unit and other annunciators.
Ranging: Auto.
Overrange Indicator: "1" in MSD column blinks.
Battery Low Indicator: BATT mark lights.
Sampling Rate: 2 per second.
Environmental Conditions (Operating): 0 ~ 40°C, < 80% RH.
Maximum Allowable Input: Volts; 700 VDC or DC + AC peak. Ω/Cnty.; 250 VAC max.
Dielectric Strength: AC 2000 V/1 min (between input terminals and case).
Power Source: Two SR-44 or LR-44 batteries. Battery current approx. 3mW.
Dimensions: 163L x 19W x 28H (mm).

Measurement Range and Accuracy

(Specified for 23°C ± 5°C. < 80% RH, no condensation.)

	Range	Resolution	Accuracy	Notes
D	2V	1mV	± 0.5%rdg ± 4dgt	Input resistance approx. 12MΩ
C	20V	10mV	± 0.7%rdg ± 4dgt	" approx. 11MΩ
	200V	0.1V	"	" "
V	500V	1V	± 1.0%rdg ± 4dgt	" "
A	2V	1mV	± 1.0%rdg ± 8dgt	Input resistance approx 12MΩ (40Hz to 500Hz)
C	20V	10mV	"	" approx. 11MΩ
	200V	0.1V	"	" "
V	500V	1V	"	" "
O	2kΩ	1Ω	± 0.7%rdg ± 4dgt.	Open-terminal voltage < 0.45V
H	20kΩ	10Ω	"	"
M	200kΩ	100Ω	"	"
S	2000kΩ	1kΩ	± 1.2%rdg ± 4dgt.	"
Continuity Test				Open-terminal voltage 1.5V (approx.)

HIOKI

NILSEN ROWE

Registered office: 200 Berkeley St.,
Carlton, Vic, 3053.

For further information about Hioki multimeters or to order a Hioki 3211 Pen – DMM multimeter, fill in this coupon. Send it to Nilsen Rowe Australia Pty. Ltd., P.O. Box 349, North Melbourne, Vic. 3051.

Please send me further information ☐ a Hioki 3211 Pen – DMM ☐

Name__________ Address__________

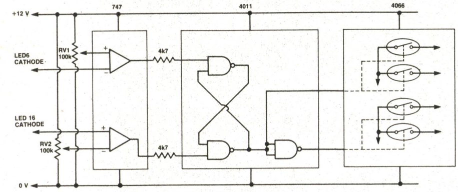
Postcode______

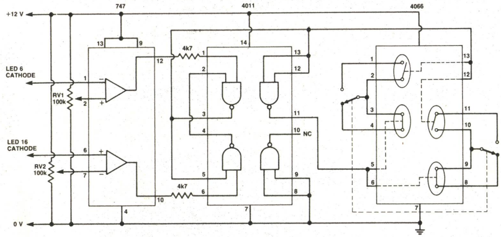
I enclose cheque/postal note for $78 or debit my Bankcard account number. ☐☐☐☐ ☐☐ ☐☐☐ ☐☐☐☐☐☐

Cardholder's signature__________

Expiry date ___/___/___

HEFK/NIL/1407R





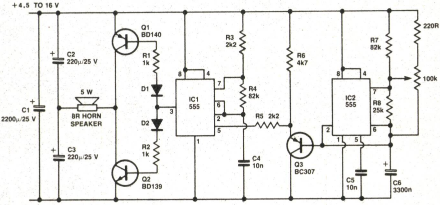
LED tacho autoranger

A modification which automatically ranges the LED tacho project, ETI-324, August 1980, has been designed by **Bill Keenan** of **West Heidelberg Victoria.**

The flying leads to the cathodes of LEDs 6 and 16 sense the drop in voltage as the LEDs turn on. This is compared to the preset voltages produced by RV1 and RV2, by the comparators of the 747. The highs and lows are fed into the 4011, which is wired as a flip flop. The 4066 and one gate of the 4011 are wired as a DPDT switch, which eliminates the switch in the tacho circuit. One gate of the 4011 is no used, so its inputs are earthed. Pins 4 and 8 of the 4066 go t low range calibration, and pin 1 and 11 go to high rang calibration.

RV1 adjusts the revs a which the tacho swaps to lo range and RV2 adjusts the rev at which it swaps to high range. The tacho must b re-calibrated after this modification, due to the 90 ohm resistance across the switches i the 4066.

Cheap high output alarm



Alec Phillips of **Myrtleford Victoria** has modified the circuit for the American siren from '555 timer applications' in ETI Circuit Techniques Vol 1. The sound is similar to the Victorian ambulance siren and the output is boosted by the addition of C2, C3, Q1, Q2, R1 and R2.

By driving one or two 8 ohm, 5 W horn speakers, the output at close range is quite deafening when using a 12 V supply.

Apart from the output, the only other changes to the original circuit are both timing sections of the 555's — this gives the required frequency and modulation for the particular type of sound required.

For a variety in sound modulation, R7 may be changed to 220 ohms, and R8 changed for a 100k trimpot with the wiper connected to pin 7 of IC2 as shwon. This will change the sound to a rapid 'whip-whip' sound in one direction through to a 'wow-wow' in the other direction. Modulation varies from about 6 or 7 Hz to about 1 Hz just short of the end of the wiper travel.

Note: If the alarm is to be used with two speakers and/or above 6 V, Q1 and Q2 must have moderate heatsinks. If two speakers are used at 9 to 16 volts it gives a better output with 470 μF capacitors for C2 and C3.

Below is a list of current consumption at different voltages using 220 μF for C2 and C3, and one 8 ohm speaker:

16 V, 420 mA; 12 V, 320 mA; 9 V, 250 mA; 6 V, 160 mA; 4.5 V, 100 mA.

Using two speakers, the current increases to nearly twice th amount along with the soun output. As a further note, C1 i essential with any power sourc as it supplies power storage wit the rapidly changing curren drain.

Please consider other peopl when testing and using th alarm.

ET'S START THE NEW SCHOOL YEAR RIGHT WITH A FEW BARGAINS

FEBRUARY SPECIALS

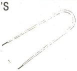
(These prices are only for Feb.
or letters post maked Feb. '84)

DON'T FORGET TO CHECK
OUR STORE SPECIALS

MN3001
(SCOOP PURCHASE FOR OUR KITS)
NORMALLY $19.95

	1-9	10+
THIS MONTH	$14.95	$13.95

BUCKET BRIGADE IC'S
SAVE, SAVE, SAVE,
EX1 IC EXTRACTOR



DON'T DAMAGE YOUR IC'S WHEN YOU HAVE TO PULL THEM OUT.

1-9	10+
$1.20	.95

2K OHM MULTIMETER

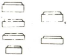
11 RANGES POCKET SIZE

SPECIFICATIONS
11 RANGES
DC VOLTAGE: 0-10-50-250-1000 volts
2000 ohms/volt
AC VOLTAGE: 0-10-50-250-1000 volts
2000 ohms/volt
DECIBELS: −10 TO +22dB in four ranges
OHMETER: 0-10 k/ohms, 0-1 megaohms
DC CURRENT: 1-100mA
NORMALLY $14.95
THIS MONTH $9.95

BUTTON CELLS

FREE CHART ON WHAT THEY FIT. CHARGE YOUR FRIENDS $4.00 TO FIT THEM INCLUDING THE BATTERY FOR FIVE MINUTES WORK.

	1-9	10+
SG13/G13	1.50	1.00
SG12/12	1.20	.80
SG10/G10	1.20	.80
SG3/G3	1.20	.80
AG13/LR44	1.00	.75
AG12/LR43	.75	.60



HI WATT BATTERIES

WE JUST LANDED A TONNE OF THESE LITTLE "HEART" STARTERS TO CHEAP THAT YOU CAN THROW THEM AWAY AFTER USING THEM ONCE IF YOU WANT TO.

	1-9	10+
AA	15c	10c
C	20c	15d
D	25c	20c
9V	40c	30c

SOLDER CENTRONICS PLUGS

(UNREAL PRICE. BUT
ABSOLUTE TOP QUALITY)

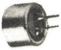
1-9	10-99	100+
$7.95	$6.95	$5.95

NORMALLY $14.95. (OUR OPPOSITION CHARGE UP TO $19.95. ARE YOU PAYING TOO MUCH FOR OTHER PRODUCTS FROM THEM AS WELL.)

WE WILL GIVE YOU
THE BEST DEAL ON
COMMODORE COMPUTERS
PLEASE RING BERNEICE
FOR THE BEST PRICE
POSSIBLE ON
(03) 489-8866

ELECTRET MIC INSERTS

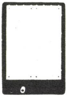
WITH PINS FOR EASY
BOARD INSERTION

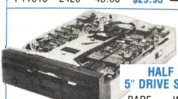


1-9	10-99	100+
$1.75	$1.65	$1.50

DON'T PAY TOO MUCH
BREADBOARD SPECIALS

CAT. No.	No. HOLES	COMP. PRICE	OUR PRICE
P11000	100	2.95	**$1.50**
P11005	640	8.95	**$5.95**
P11009	840	14.85	**$10.95**
P11012	1680	27.95	**$19.95**
P11015	2420	45.00	**$29.95**





HALF HEIGHT
5" DRIVE SPECIALISTS

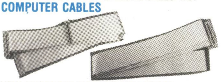
MITSUBISHI	BARE DRIVE	WITH BOX + P.S.
M4851 500K BYTE	$329.00	$369.00
M4853 1M BYTE	$359.00	$399.00
M4854 1.6M BYTE	$399.00	$439.00

MP 5" STANDARD DRIVES

B51	$0269.00	$299.00
B52	$349.00	$379.00
B91	$349.00	$379.00
B92	$439.00	$459.00

ALL DRIVE PRICES INCLUDE SALES TAX

COMPUTER CABLES



NEW PRODUCTS TO SAVE YOU HEAPS OF TIME TRYING TO CRIMP THEM IN A VICE.

P19001	SYSTEM 80 OR EARLY TRS80 2x34 WAY EDGE CONNECTORS 1 METRE 34 WAY IDC CABLE SINGLE 5¼" DRIVE CABLE	**$29.50**
P19003	SYSTEM 80 OR EARLY TRS80 3x34 WAY EDGE CONNECTORS 1 METRE 34 WAY 1DC CABLE DOUBLE 5¼" DRIVE CABLE	**$39.50**
P19005	BIG BOARD 2 OR LATE TRS80 1x34 WAY EDGE CONNECTOR 1x34 WAY IDC CONNECTOR 1 METRE IDC CABLE SINGLE 5¼" DRIVE CABLE	**$26.50**
P19007	BIG BOARD 2 OR LATE TRS80 2x34 WAY EDGE CONNECTORS 1x34 WAY IDC CONNECTOR 1 METRE IDC CABLE DOUBLE 5¼" DRIVE CABLE	**$39.50**

THIS MONTH SOMETHING FREE! FREE! FREE!
WITH EACH PURCHASE.

DATA BOOKS, DATA BOOKS
YOU WILL NEED THESE FOR SCHOOL

FAIRCHILD CMOS	$9.95
NATIONAL LOGIC TTL	$9.95
NATIONAL LINEAR I	$9.50
NATIONAL LINEAR II	$9.50
NATIONAL CMOS	$9.50
NATIONAL LINEAR APPLICATIONS	$14.50

CHASIS PUNCH SET

(WE KNOCK A HOLE IN THE
OPPOSITION'S PRICES
ON THIS ONE) **$16.95**

JOYSTICKS

(AS USED IN YOUR STANDARD COIN OPERATED MACHINE'S. THESE SHOULD GIVE YEARS' OF SERVICE AS USED BY THE PROFESSIONAL OPERATORS.)

	1-9	10+
2 WAY (2 MICROSWITCHES)	21-50	18-50
4 WAY (4 MICROSWITCHES)	23-50	19-50

DIP SWITCHES 4 WAY $1.00
8 WAY $1.50

AA NICADS

1-9	10-99	100+
1-75	1-60	1-50

NORMALLY $2.50 EACH

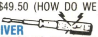
BARGAIN HUNTERS CORNER

(GET YOUR BIG GAME HERE)

THE STING DISK FOR MICROBEE™ 50 only in stock WAS $395.00 NOW $195.00. GET IN QUICK.

5 CP-80 RIBBONS FOR $49.50 (HOW DO WE DO IT?)

NEON TEST SCREWDRIVER



WE HAVE ZAPPED THE PRICE TO 75 CENTS

OUR NEW RANGE OF OSCILLOSCOPES ARE ON THE WAY
ASK FOR DETAILS. SHOULD ARRIVE LATE FEBRUARY

15 MHz AC-DC PORTABLE	$695.00 Including Tax
20MHz Dual Track	$495.00 Including Tax
45MHz Dual Track	$995.00 Including Tax

Probes are extra at $29.50 each

BUY IN LOTS OF 10 AND SAVE

PIC A PAK SPECIALS

10 2SJ49 for	$49.00	10 74C926 for	$59.00
10 2SK134 for	$49.00	10 2732 for	$49.00
10 2N3055 for	$7.50	10 2764 for	$79.00
10 BUX80 for	$39.00	10 74LS245	$12.00
10 BD139 for	$3.90	10 4164 for	$69.00
10 BD140 for	$3.90	10 7400 for	$2.90
10 RED LEDS 5mm	.90	10 H1044 DELUXE	
10 GREEN LEDS	$1.40	METAL CASES for	$49.50

LINE FILTERS 3 AMP 240 VAC.
$11.95

JUST ARRIVED (WE HOPE)
NEW DIGITAL MULTIMETER

PUSH
BUTTON
CONTROLS
BUT UNDER
$60.00

WOW!!!
10 AMP

1-9	10+
59-95	52.50

ROD IRVING ELECTRONICS

425 High St., Northcote, Vic. 48-50 A'Beckett St., Melb., Vic.
Phone (03) 489 8866, (03) 489 8131, Mail Order Hotline (03) 481 1436
Mail orders to P.O. Box 235 Northcote 3070 Vic.

Minimum P & P $3.00. Errors & omissions excepted.
Please address tax exempt, school, wholesale and dealer enquiries

RITRONICS WHOLESALE

1st floor 425 High St. Northcote 3070 (03) 489 7099 (03) 481 1923
Telex AA 38897

Car fuel gauge

Phillip Wolstencroft,
Wentworthville, NSW

I had the need for an accurate fuel gauge so I set about designing a digital model. The maximum readout of this unit is either 99.9 gallons or 99.9 litres. This could easily be expanded but I doubt the need would arise in most family cars or recreation vehicles.

As most fuel gauge 'senders' put out about 5 V when the tank is empty, 0 V when full, I decided to use a load-preset/countdown method.

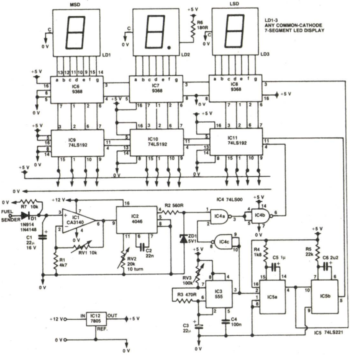
Looking at the circuit, the output from the sender is fed via D1 to IC1's non-inverting input. D1, R7 and C1 reduce input fluctuations caused by petrol slosh. R1 and RV1 set the voltage gain of IC1, the output of which is fed to the input of IC2, configured as a voltage-controlled oscillator. RV2 and C2 set IC2's nominal output frquency. The output from IC2 is gated through a NAND gate, inverted and fed into the CLK input of the presettable up/-down counter comprised of ICs 9, 10 and 11. These are all 74LS192s with the carry output of the first fed to the clock input of the following stage, etc. Note that the output of IC2 is clipped by the action of ZD1 to 5 V to suit the input of IC4.

A 555, IC3, and associated components sets the counter update period. IC5 is a dual monostable multivibrator. IC3 begins with its output being low, which allows the CLK pulses to be fed to th counters. IC3 times out and pi 3 goes high, stopping the CLK pulses and triggering the firs one-shot, IC5a. This latche the 9368s. When latching ha finished, the second one-shot i triggered (IC5b), which load the preset values present on P to P3 of each of the '19 counters. These preset input are wired to the binary value c the car's fuel tank capacity Note that the LED displays d not require resistors. Only th decimal point on LD2 require a current limiting resistor.

To calibrate it, RV3 is set t the desired update period; RV is set so that when the tank empty, the voltage on pin 6 c IC1 is 12 volts; finally, onc these calibrations have bee done, RV2 is adjusted so th the displays read a know value of fuel in the tank - preferably fairly low (1 or gals, 4-5 ltrs).

In this circuit, the reading in gallons, determined by th VCO frequency. Reduce th value of C2 to read in litres - some experimentation may necessary.

A suitable small heatsi should be bolted to the tab the 7805 (IC12).



PRIZE WORTH $90!

'IDEA OF THE MONTH' CONTEST

COUPON

Cut and send to: Scope/ETI 'Idea of the Month' Contest, ETI Magazine, P.O. Box 227, Waterloo NSW 2017.

"I agree to the above terms and grant *Electronics Today International* all rights to publish my idea in ETI Magazine or other publications produced by it. I declare that the attached idea is my own original material, that it has not previously been published and that its publication does not violate any other copyright.*"
* Breach of copyright is now a criminal offence.

Title of idea ....

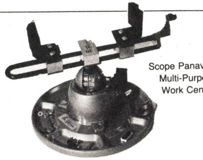
Signature ....

Name ....

Date ....

Address ....

.... **Postcode** ....



Scope Panavise
Multi-Purpose
Work Centre.

Scope Laboratories, which manufactures and distributes soldering irons and accessory tools, is sponsoring this contest with a prize given away every month for the best item submitted for publication in the 'Ideas for Experimenters' column — one of the most consistently popular features in ETI Magazine. Each month, we will be giving away a Scope Panavise Multi-Purpose Work Centre, Model 376/300/312, comprising a self-centering head (376), standard base (300) and tray base mount (312), all worth about $90! Selections will be made at the sole discretion of the editorial staff of ETI Magazine. Apart from the prize, each winner will be paid $10 for the item published. You must submit original ideas of circuits which have not previously been published. You may send as many entries as you wish.

RULES

This contest is open to all persons normally resident in A tralia, with the exception of members of the staff of Sc Laboratories, The Federal Publishing Company Pty Limit ESN, The Litho Centre and/or associated companies.

Closing date for each issue is the last day of the mor Entries received within seven days of that date will accepted if postmarked prior to and including the date the last day of the month.

The winning entry will be judged by the Editor of Magazine, whose decision will be final. No corresponde can be entered into regarding the decision.

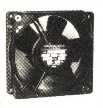
The winner will be advised by telegram the same the result is declared. The name of the winner, toget with the winning idea, will be published in the next poss issue of ETI Magazine.

Contestants must enter their names and addres where indicated on each entry form. Photostats or cle written copies will be accepted but if sending copies must cut out and include with each entry the month page number from the bottom of the page of the contest other words, you can send in multiple entries but you need extra copies of the magazine so that you send original page number with each entry.

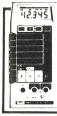
This contest is invalid in states where local laws proh entries. Entrants must sign the declaration on the cou that they have read the above rules and agree to abide their conditions.

TO THE ELECTRONICALLY MINDED. (Professionals, Hobbyists, Students & Enthusiasts.)

We carry a wide range of Multimeters, Calculators, Soldering tools, Transformers, Cables, Instrument boxes, Computer Connectors, TV Aerials, Components and just about anything you may require.



E.B.M. FAN
$22.94



MULTI-METERS

- UNIVERSITY
- FLUKE
- PARAMETER

CALCULATORS

- CASIO
- TEXAS INST
- HEWLETT-PACKARD HP41C

Now in stock.

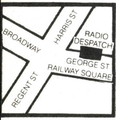
SOLDERING TOOLS

- WELLER
- ROYEL

RADIO DESPATCH SERVICE

869 George St., Sydney
NSW 2000 (Near Harris St.)
Tel. 211 0816
211 0191

Open: Mon-Fri 8.30am to 5.30pm
Thursday night late shopping
till 6.30pm Sat 8am to 12.00pm



"QUALITY COMES FIRST" has been our trading principle for many years. This enables us to give you the best in service and the best in products...ensuring durability in what you buy and your own guaranteed satisfaction.

MAIL ORDERS TO RADIO DESPATCH SERVICE
869 George St., Sydney 2000 Tel. (02) 211 0191 • 211 0816

ANNOUNCING THE NEW *Multitech* RANGE

Micro-Professor MPF-III

THE LATEST TECHNOLOGY
IN64K MICRO COMPUTERS
DUAL PROCESSORS — 6502 and Z80
RUN APPLE IIe AND CP/M+ SOFTWARE

INTRODUCTORY PACKAGE
FEBRUARY ONLY

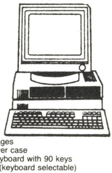
	RECOMMENDED EX TAX PRICE
MPF III	$699
GREEN PHOSPHOR MONITOR	$180
DISK DRIVE	$259
DISK DRIVE INTERFACE CARD	$ 75
Z80 CARD	$ 75

TOTAL VALUE $1288

ALL FOR ONLY $999 Sales Tax Exempt

SAVE $289

3 MONTHS FULL WARRANTY, COMPLETE BACK UP OF SPARES AND SERVICE FACILITIES GUARANTEED BY EMONA FOR A MINIMUM OF 3 YEARS.



STANDARD FEATURES

- Runs 8 languages
- Upper and lower case
- Detachable keyboard with 90 keys
- 40/80 column (keyboard selectable)
- Centronics printer interface
- 36 tone sound generation chip
- Powerful editing features
- 4 additional expansion slots
- One key basic command entry
- 12 programmable function keys
- Numeric key pad
- R.F. modulator
- Cassette interface
- High and low resolution colour graphics
- 64K RAM 24K ROM
- Comprehensive operation manual

MIC-504 OFFICE POWER

FOR ONLY
$3495
(Sales Tax Exempt)

- The MIC-504 is a 64K single board computer based on the Z80A microprocessor.
- Two 5.25 inch double sided, double density, floppy disk drives provide 2 Megabytes of on-line storage.
- MIC-504 comes with a package of software that includes Word Right, Spell Right, Magic worksheet, Qsort, Analyst and Name and Address.
- The operating system is CP/M 2.2 which makes the large library of existing software available for immediate application.
- Two full duplex RS-232C serial ports and one parallel port with a centronics interface enables expansion of the system.
- The CRT is a 12" diagonal etched green phosphor screen with 80 x 24 display and 7 x 11 dot matrix character size.

MPF-V Coming Soon — 128K, 16BIT, 8088, IBM Compatible.

EMONA COMPUTERS PTY. LTD.

Wholesale and Retail
2nd Flr., 661 George St. Ph. 212-4815 or 212-3463

PC 84 The 2nd Australian Personal Computer Show Centrepoint Sydney 14-17 March 1984

SEE US ON STAND 122

APPLE Reg Trade Mark of APPLE Computer Inc.
+CP/M Reg Trade Mark of Digital Research Inc.
Reg Trade Mark of International Business Machine Corp.

*Micro Professor is the trademark of MULTITECH INDUSTRIAL CORP.

Full range of educational, personal and business computers from Multitech — Genuine dealer inquiries welcome.

SHOP AROUND

The LM335

Lab. Notes this issue focusses on the LM335, a solid-state temperature transducer. You should be able to obtain it, and related devices mentioned in the article, from firms such as **Rod Irving Electronics** and **Ellistronics** in Melbourne, **Jaycar** and **Geoff Wood Electronics** in Sydney. You might also try **Radio Despatch Service.**

ETI-644A d-c modem revised

In general, those firms who previously supplied this modem will be supplying kits of the revised version. Try **Jaycar** in Sydney, **Rod Irving Electronics** in Melbourne and **Altronics** in Perth. Jaycar should have kits available this month, they advise.

Several approved line isolation transformers can be used. The original type specified (October '82 ETI), was a type 45035 by Arlec. These are still available, though a touch on the expensive side at around $20 retail. However, it was the only approved model then available retail. Two somewhat cheaper types are now manufactured locally by Ferguson Transformers and should be readily available through retail electronics suppliers. Designated MT-620 and MT-627, both meet the requisite Telecom approval specifications and the revised pc board will accommodate both the Arlec and Ferguson transformers.

As before, we have retained copyright on the pc board and they are manufactured for us. If you're assembling the components from your own resources, then pc boards are available direct from us for $55, post paid. Send your cheque or money order to:

ETI-644A Modem PC Board
ETI Magazine
PO Box 227
Waterloo, NSW 2017

MEET THE IC IN FUN WAY 3

Dick Smith's Fun Way 1 and 2 books and kits are now joined by the latest in the series, Dick Smith's Fun Way Into Electronics — Volume Three.

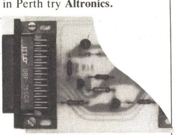
Comprising a clearly written, well-illustrated book and 10 new project kits, Fun Way 3 is the next natural progression in the series and is devoted entirely to using those funny black rectangles with lots of legs — integrated circuits.

Besides detailed project instructions, the book is packed with hints and tips on soldering, using a multimeter and making pc boards as well as information on components, technical terms and codes. Listed as Cat. B-2610, it costs $6.95.

Components to build each of the projects are available as individually packaged kits. They include: a mini colour organ, two-up game, LED poker machine, mini stereo amp, car burglar alarm and more! The Fun Way 3 book and kits are available from any of the 40 Dick Smith Electronics stores Australia-wide.

ETI-676 RS232er

This project will likely be stocked by those firms supporting our series of projects for the Microbee: **Magraths** and **Rod Irving Electronics** in Melbourne, but try **All Electronic Components** and **Billco,** too; in Sydney, try **Avtek** and **Jaycar;** in Perth try **Altronics.**



The Intersil ICL7660 supply rail inverter IC is imported by R&D Electronics and **All Electronic Components of 118 Lonsdale St, Melbourne** act as their retail distributors.

The DB25 right-angle pc mount plug and socket set we purchased from Avtek, but most savvy suppliers carry them these days.

Ready-made pc boards should be available from **Rod Irving Electronics, All Electronic Components and Jaetronics** in Melbourne, **Altronics** and **Jemal** in Perth and **Better PC Boards** in Sydney. **Avtek** and **Jaycar** in Sydney (York St) should also be able to supply the pc boards for this project.

If you're going to etch a drill your own pc board th negative or positive film a work can be obtained fro 'ETI-676 Artwork', ETI Mag zine, PO Box 227, Waterlo NSW 2017, for the munifice sum of $2 (two bucks), po paid. Make sure you reque positive or negative, accordi to what your resist requires.

ETI-274 damn fast NiCad charger

This is a straightforward pro ect for which all the comp nents can be obtained over t counter at virtually any ele tronic components supplie For a kit, try **Rod Irving Ele tronics** and **All Electronic Co ponents** in Melbourne.

Ready-made pc boar should be obtainable from **R Irving Electronics, All Ele tronic Components** and **Ja tronics** in Melbourne, **Bett PC Boards** and **Jaycar** in Sy ney, **Jemal** in Perth.

If you want to make yo own board, negative or positi film artwork can be obtain for just $1, post paid, fro 'ETI-274 Artwork', ETI Mag zine, PO Box 227, Waterlo NSW 2017. Please make su you ask for positive or neg tive, according to what y require.

AUSTRALIAN
BROADCASTING CORPORATION

The A.B.C. is an equal opportunity employer

TECHNICAL WRITER
SYDNEY
$26,899 p.a.

The Australian Broadcasting Corporation has a vacancy for a Technical Writer in its Engineering Training Section in Sydney. The principal duties are the preparation of publications for operational and technical courses in radio and television.

Applicants must possess the Electronics Engineering Certificate and the Television Operators Certificate of Proficiency or their equivalents. The A.B.C. will arrange for the successful applicant to undertake a training officer's course.

Applications to Employment Officer (BH), A.B.C., G.P.O. Box 9994, Sydney, 2001. Mark envelope "Application-Confidential". Applications close Wednesday, 15th February, 1984

59949

ETI Book Sales

electronics textbooks

LECTRONICS: IT'S EASY — VOL 1
0001E **$5.95**
eters, resistance, capacitance and induct-
nce, emitter followers, op-amps, power
upplies, electronic filters.

LECTRONICS: IT'S EASY — VOL 2
0002E **$5.95**
igital sub-systems, counters and shift regis-
rs, A-D and D-A conversion, digital instru-
ents and test equipment, computers, trans-
ission links, oscilloscopes.

SSENTIAL THEORY FOR THE
LECTRONICS HOBBYIST
0013B **$5.95**
upplies the electronics hobbyist with the
ackground knowledge which will exactly suit
is specific requirements. Minimum maths.

TRODUCTION TO AUTOMOTIVE
OLID-STATE ELECTRONICS
0015P **$14.95**
or the professional as well as the home
echanic — explains the functions of most on-
oard automotive black boxes and logic sys-
ems, including anti-skid braking, electronic
park control and diagnostic systems.

IGITAL COUNTER HANDBOOK
0332P **$17.25**
overs general principles and explains con-
epts such as accuracy, precision and stability.
he emphasis is on digital-counter test and
easuring equipment, but also deals with
ementary counters, both electronic and
echanical.

OLID-STATE POWER ELECTRONICS
0336P **$17.95**
p-to-date information on the various solid-
ate devices, techniques and circuits used for
ower electronics applications.

reference and data handbooks

TERNATIONAL TRANSISTOR
QUIVALENTS GUIDE
0018B **$9.95**
ontains a huge amount of information on
odern transistors produced by more than 100
anufacturers. Wherever possible, equivalents
e subdivided into European, American and
apanese types.

ALL CHART — HOW
IDENTIFY UNMARKED ICs
0019B **$2.95**
is chart shows the reader how, with just a
st-meter, to go about recording the particular
ignature' of an unmarked IC which should
able the IC to be identified with reference to
anufacturers or other data.

ALL CHART — RADIO, ELECTRONICS,
EMI-CONDUCTORS AND LOGIC SYMBOLS
0020B **$2.95**
entify those symbols at a glance. A must for
eginners and advanced enthusiasts alike.
ofessionals can always hide it in their desks!

WALL CHART — RADIO AND ELECTRONIC COLOUR CODES AND DATA
B0021B **$2.95**
This chart covers all colour codes in use throughout the world. For all radio and electronic components made in Britain, United States, Europe and Japan.

REFERENCE DATA FOR RADIO ENGINEERS
B0023P **$54.50**
Largest and most comprehensive collection of equations, graphs, tables, and other reference data needed in radio engineering and design.

CONTEMPORARY MATHEMATICS FOR ELECTRONICS
B0024P **$35.95**
This book is split into three sections. Direct current maths introduces the student to the calculator, fractions and dimensional analysis. Alternating current maths covers phasors, quadratics and RMS in both sine and digital waveforms. Active device maths introduces number systems and boolean.

THIS MONTH'S SPECIAL

FIRST BOOK OF PRACTICAL ELECTRONIC PROJECTS

Normally $4.95; this month only,

$3.70

Full constructional data, circuits, components lists for many practical projects including audio distortion meter, guitar amp, metronome, etc. To order, quote book number CX035B.

Limited supplies

ARRL ELECTRONICS DATA BOOK
B0335R **$5.75**
Covers maths aids and tables, times and frequency, rf circuit data, LCR networks, transformers, filter design, antennas and feed systems, solid state circuits, constructions and testing data. Limited supplies.

INTERNATIONAL DIODE EQUIVALENTS GUIDE
B0339B **$6.95**
Includes zener diodes, LEDs, diacs, triacs, thyristors, OCIs, photo diodes, display diodes and simple rectifier diodes.

RESISTOR SELECTION HANDBOOK
B0348B **$2.95**
Shows how to combine two preferred values of resistor to obtain virtually any required value of resistance. Includes information about fixed resistors, standard ranges, colour codes and markings, power ratings and resistor calculations.

REACTANCE/FREQUENCY CHART FOR AUDIO AND RF
B0381B **$2.95**
Enables the reactance of any capacitor or resistor to be read off immediately, from 10 Hz to 100 MHz. Also applies to resonant frequencies of LC networks. Limited supplies.

electronics for beginners

BEGINNER'S GUIDE TO DIGITAL ELECTRONICS
C0029B **$4.95**
Covers all essential areas including number systems, codes, constructional and sequential logic, analogue/digital/analogue conversion.

BEGINNER'S GUIDE TO BUILDING ELECTRONIC PROJECTS
C0030B **$6.95**
Enables total beginners to tackle electronic projects. Includes component identification, tools, soldering, building methods, cases, legends, etc, etc. Practical basic projects are included.

HOBBY ELECTRONICS PROJECT BOOK
C0031E **$4.95**
Fifty projects, ranging from very simple ones for complete beginners to more elaborate ones for those with more experience.

ELECTRONIC PROJECTS FOR BEGINNERS
C0038B **$6.95**
This book gives the newcomer to electronics a wide range of easily built projects. Actual components and wiring layouts aid the beginner. Some of the projects may be built without using soldering techniques.

POPULAR ELECTRONIC PROJECTS — BOOK 1
C0039B **$6.95**
A collection of the most popular types of circuits and projects to interest most electronics constructors. The projects cover a wide range and are divided into four basic types: radio, audio, household and test equipment.

EASY ELECTRONICS: CRYSTAL SET CONSTRUCTION
C0041B **$6.75**
For those who wish to participate in the intricacies of electronics more through practical construction than by theoretical study. The circuits are based on those from earlier publications but have been modified to use modern components and home-wound coils.

IC PROJECTS FOR BEGINNERS
C0042B **$6.75**
Especially written for the less experienced hobbyist, and offers a range of fairly simple projects based around a number of popular and inexpensive linear and digital ICs. Complete layout and point-to-point wiring diagrams.

SOLID-STATE NOVELTY PROJECTS
C0043B **$4.95**
A number of novelty projects using modern ICs and transistors. Includes a musical instrument played by reflecting a light beam with your hand, water warbler for pot plants, music tone generator, LEDs and ladders game, touch switch, electronic roulette wheel, etc.

SIMPLE PROJECTS — VOL 2
C0256E **$2.95**
Contains easy projects plus chapters on construction techniques and useful information on components.

15 SATURDAY ARVO PROJECTS
C0268E **$1.50**
Projects include transistor-assisted ignition, sound bender, radio microphone, simple sound effects, Alien invaders, etc, etc.

Save time and trouble with mail order — simply fill out the reply-paid coupon!

140 Joynton Avenue, Waterloo, NSW 2017, Australia. Phone (02) 663-9999 Sydney. Telex 74488.
Postal Address: ETI Book Sales, PO Box 227, Waterloo, NSW 2017.

ETI PROJECT ELECTRONICS
C0269E ***$4.95***
Twenty-six projects for beginners, including battery saver, electronic siren, Morse practice set, FM antenna, etc, etc. Fifth edition.

constructional projects

SINGLE IC PROJECTS
D0058B ***$5.50***
Simple to build projects based on a single IC. A few projects use one or two transistors as well. A stripboard layout is given for each project plus special constructional and setting up info. Contents include low-level audio circuits, audio power amps, timers, op-amps and miscellaneous circuits.

ELECTRONIC SECURITY DEVICES
D0059B ***$6.95***
Besides including both simple and more sophisticated burglar alarm circuits using light, infra-red and ultra-sonics, this book also gives circuits for gas and smoke detectors, flood alarms, fire alarms, doorphones, etc. Limited supplies.

POPULAR ELECTRONIC CIRCUITS — BOOK 1
D0060B ***$6.75***
Includes audio, radio, test gear, music projects, household projects and many more. An extremely useful book for all hobbyists, offering remarkable value.

POPULAR ELECTRONICS CIRCUITS — BOOK 2
D0061B ***$7.75***
A wide range of designs for electronics enthusiasts who are capable of producing working projects from just a circuit diagram without the aid of detailed information.

MINI-MATRIX BOARD PROJECTS
D0062B ***$6.75***
This book provides a selection of 20 useful circuits which can all be built on a mini-matrix board which is just 24 holes by 10 copper strips in size. Simple and easy for those with not much experience in electronics.

MULTI-CIRCUIT BOARD PROJECTS
D0063B ***$6.75***
All circuits are based on one specially designed pc board. Recommended to the less experienced hobbyist.

AERIAL PROJECTS
D0064B ***$6.75***
Practical aerial designs including active, loop and ferrite which are relatively simple and inexpensive to build. The complex theory and mathematics are avoided.

MODERN OP-AMP CIRCUITS
D0065B ***$6.75***
A collection of widely varying circuits and projects based on the op-amp ICs.

ELECTRONIC TIMER PROJECTS
D0066B ***$6.75***
These may have a high degree of accuracy with quartz control or they may be quite simple designs, using only a few components. A number of specialist timer projects are car windscreen-wiper delay unit, darkroom timer, metronome, etc.

ELECTRONIC PROJECTS FOR CARS AND BOATS
D0067B ***$6.75***
Fifteen fairly simple projects designed for use with 12 V electrical systems but in some cases can also be employed with 6 V and/or positive earth systems.

ELECTRONIC PROJECTS FOR CARS
D0261E ***$4.95***
Projects include car alarm, reversing alarm, over-rev alarm, twin-range tachometer, breakdown beacon, intelligent battery charger, etc.

ETI TOP PROJECTS — VOL 5
D0263E ***$3.00***
Includes photographic strobe, bucket brigade audio delay line, white line follower, house alarm, etc, etc.

ETI TOP PROJECTS — VOL 6
D0264E ***$4.95***
Revised second edition. Projects include theatrical lighting controller, simple intercom, electromyogram for biofeedback use, Series 4000 four-way loudspeaker, etc, etc.

ETI TOP PROJECTS — VOL 7
D0265E ***$3.95***
Includes geiger counter, AM tuner, laser, simple metal detector, discriminating metal detector, dc power supply, etc, etc.

ETI TOP PROJECTS — VOL 8
D0266E ***$4.95***
Includes UHF to VHF television converter, universal process timer, sound bender, percussion synthesiser, etc, etc.

ETI TOP PROJECTS — VOL 9
D0267E ***$4.95***
Includes a radioteletype-computer decoder, model railway points controller, universal dc-dc converter, MicroBee EPROM programmer, etc.

THIS MONTH'S SPECIAL

LEARNING TO WORK WITH INTEGRATED CIRCUITS
Normally $2.35; this month only,
$1.75
Discover the basics of integrated circuits while building a simple and useful electronics project. A complete collection of the popular American QST series. To order, quote book number EX318R.
Limited supplies

52 PROJECTS USING IC741
D0386B ***$3.95***
Projects include remote thermometer, servodriver, rev counter for petrol and diesel engines, voltage amplifier and a record amplifier with bass boost.

ELECTRONIC SCIENCE PROJECTS
D0413B ***$5.95***
Twelve electronic projects with a scientific flavour — each project includes details on how it works, construction and use. Includes a simple infra-red laser, a low-cost solid-state oscilloscope, a pH meter, and electronic stethoscope and an electronic seismograph.

circuit techniques and design

50 PROJECTS USING RELAYS, SCRs AND TRIACS
E0068B ***$6.95***
Practical working circuits using silicon controlled rectifiers, relays and bi-directional triodes. With a minimum of difficulty you can use them in motor control, dimming and heating control, timing and light sensitive circuits, warning devices and many others.

50 FET PROJECTS
E0069B ***$5.95***
Projects include amplifiers and converters, test equipment, tuners, receivers and receiver aids, mixers and tone controls, etc, etc. The FET used is not critical. This book is of interest and value to SW listeners, radio amateurs, hi-fi enthusiasts and general experimenters.

ETI CIRCUITS — BOOK 1
E0070E ***$2.95***
Many of these circuits have been published in the 'Ideas for Experimenters' Section of ETI.

ETI CIRCUITS — BOOK 2
E0071E ***$2.95***
See Book 1.

ETI CIRCUITS — BOOK 3
E0072E ***$2.95***
See Book 1.

ETI CIRCUITS — BOOK 4
E0073E ***$2.95***
See Book 1.

DESIGN OF PHASE-LOCKED LOOP CIRCUITS, WITH EXPERIMENTS
E0074P ***$16.95***
An excellent introduction to the theory, design and implementation of phase-locked loop circuits using various TTL and CMOS devices. Includes manufacturers' data sheets and describes the use of breadboarding aids in laboratory-type experiments.

ETI CIRCUIT TECHNIQUES — VOL 1
E0076E ***$4.95***
The how, what, which, where, why and how much anthology of components, circuits and techniques. Second printing.

ETI CIRCUIT TECHNIQUES — VOL 2
E0077E ***$4.75***
See Volume 1.

ETI CIRCUIT TECHNIQUES — VOL 3
E0078E ***$4.95***
See Volume 1.

RF CIRCUIT DESIGN
E0079P ***$36.95***
A practical approach to the design of RF amplifiers, impedance-matching networks and filters. Uses a minimum of complex maths.

50 CMOS IC PROJECTS
E0080B ***$5.95***
Projects include multivibrators, amplifiers and oscillators, trigger devices and other special devices.

SECOND BOOK OF CMOS IC PROJECTS
E0081B ***$5.95***
Leading on from *50 CMOS IC Projects*, this second book provides a further selection of useful circuits of a simple nature. Contents have been selected to ensure minimum overlap between the two books.

COUNTER DRIVER AND NUMERAL DISPLAY PROJECTS
E0082B ***$5.95***
Author F.G. Rayer features applications and projects using various types of numerical displays, popular counter and driver ICs, etc.

ELECTRIC CIRCUITS AND NETWORKS
E0091P ***$18.75***
Comprehensive explanation of the theory, with numerous examples and solved illustrative problems.

HOW TO USE OP-AMPS
E0092B ***$7.75***
Design notes and applications on many topics including basic theory, amplifiers, power supplies, audio circuits, oscillators, filters, computers and control engineering. It's written around the 741 IC but includes design notes for most of the common op-amps.

50 PROJECTS USING CA3130 ICs
E0101B ***$4.50***
The CA3130 is an advanced operational amplifier capable of higher performance than many others: circuits often need ancillary components. Audio projects, RF projects, test equipment, household projects.

PRACTICAL INTRO TO DIGITAL ICs
E0102B ***$5.95***
Introduction to digital ICs (mainly TTL 7400). Besides simple projects, includes logic test set to identify and test digital ICs. Also includes digital counter-timer.

50 CIRCUITS USING GERMANIUM, SILICON AND ZENER DIODES
E0103B ***$5.95***
Fifty interesting and useful circuits and applications using the germanium and silicon signal diodes, silicon rectifier diodes and zener diodes, etc.

DESIGN OF VMOS CIRCUITS, WITH EXPERIMENTS
E0104P *$17.75*
The authors look at the technology which makes dramatic advancements possible with VMOS, and show how these components can easily be integrated into common circuit designs to enhance their responses.

UNDERSTANDING CMOS INTEGRATED CIRCUITS
E0105P *$9.95*
This book tells you what CMOS ICs are, how they work, and how they can be used in electronic circuit designs. Practical circuits, with parts values, are included.

GUIDE TO CMOS BASICS, CIRCUITS, AND EXPERIMENTS
E0107P *$14.95*
If you are already familiar with TTL devices and are ready to examine the benefits of CMOS, this book is your complete source. It tells you what CMOS devices are, their characteristics and design rules. Experiments demonstrate the concepts discussed.

50 SIMPLE LED CIRCUITS — BOOK 1
E0108B *$4.50*
Fifty interesting circuits and applications using the LED. Includes circuits for the 707 common anode display for the beginner and advanced enthusiast.

C 555 PROJECTS
E0109B *$6.75*
One wonders how life went on before the 555! ncluded are basic and general circuits, car and railway circuits, alarms and noise makers plus section on subsequent 556, 558 and 559s.

LM 3900 IC PROJECTS
E0110B *$4.75*
Unlike conventional op-amps, the LM 3900 can be used for all the usual applications as well as many new ones. It's one of the most versatile, reely obtainable and inexpensive devices around. This book provides the groundwork for simple and advanced uses — it's much more han a collection of projects. Recommended.

VMOS PROJECTS
E0112B *$6.75*
Though primarily concerned with VMOS power FETs and their applications, power MOSFETs are dealt with, too, in a chapter on audio circuits. Projects include audio circuits, sound generator circuits and signal circuits.

C CONVERTER COOKBOOK
E0139P *$22.75*
Written for the practising engineer, technician, hobbyist or student, this book will be an nvaluable working guide to the understanding and use of IC analogue/digital and digital/analogue converters.

HOW TO DESIGN AND MAKE YOUR OWN PCBs
E0284B *$6.95*
Covers the practical aspects of printed-circuit board design and construction.

LEARNING TO WORK WITH INTEGRATED CIRCUITS
E0318R *$2.35*
Discover the basics of integrated circuits while building a simple and useful electronics project. A complete collection of the popular American *QST* series.

0 SIMPLE LED CIRCUITS — BOOK 2
E0346B *$4.95*
Fifty useful circuits and applications using the LED to complement Book 1 (ETI Book Sales No. E0108B). Includes diode tester, unijunction LED flasher, car voltage probe, SCR tester, use tester and simple timer.

test equipment and fault-finding

HOW TO GET YOUR ELECTRONIC PROJECTS WORKING
F0114B *$6.95*
Helps you to overcome the problems of a circuit hat doesn't work by indicating how and where o start looking for many of the common faults hat can occur when building up a project.

WALL CHART — TRANSISTOR RADIO FAULT-FINDING
F0115B *$2.95*
Used properly, this chart should enable the reader to trace most common faults quickly. Across the top of the chart are four rectangles containing brief descriptions of the faults. Selecting the appropriate fault, the reader simply follows the arrows and carries out the suggested checks until the fault is cleared.

PRACTICAL REPAIR AND RENOVATION OF COLOUR TELEVISIONS
F0116B *$6.55*
This book shows how to obtain a working colour television for very little outlay by repairing and renovating a set that has been 'written off' by a dealer. Includes practical details of how to construct your own CRT tester/rejuvenator and cross-hatch generator.

TEST GEAR — METERING AND POWER-SUPPLY PROJECTS
F0118E *$3.00*
Includes many types of meters, audio noise and signal generators, CMOS tester, oscilloscope calibrator, etc.

TROUBLESHOOTING WITH THE OSCILLOSCOPE
F0121P *$16.95*
Excellent for the professional service technician or the serious hobbyist, as it combines step-by-step procedures for using the scope with the specific nuts and bolts of television receiver troubleshooting.

ELECTRONIC TEST EQUIPMENT CONSTRUCTION
F0122B *$5.95*
Describes construction wide range of test gear, including FET amplified voltmeter, resistance bridge, field strength indicator, heterodyne frequency meter, etc.

TEST GEAR — VOL 3
F0255E *$4.95*
Projects include RF attenuator, op-amp tester, tacho calibrator, transistor tester, mains cable seeker, electric fence tester, portable core-balance relay, etc.

ELECTRONIC TROUBLESHOOTING HANDBOOK
F0257P *$10.50*
This workbench guide shows you how to pinpoint transistor troubles in minutes, how to test almost everything electronic and how to get the most out of low-cost test equipment.

THIS MONTH'S SPECIAL

THE 6809 COMPANION

Normally $6.95; this month only,

$5.15

A discussion of the features of the 6809 and a reference guide. Don't be deceived — it's more than just a beginner's guide to microprocessors. To order, quote book number JX154B.

Limited supplies

USE OF THE DUAL-TRACE OSCILLOSCOPE
F0259P *$23.75*
This programmed text breaks down the process of operating a scope into a series of logical steps, starting with the deflection of the electron beam and continuing through proper use of the triggering controls to measure the phase difference between two waveforms.

HOW TO BUILD YOUR OWN SOLID-STATE OSCILLOSCOPE
F0282B *$6.95*
This book comprises a project divided into sections for builder to individually construct and test — then assemble into complete instrument. Includes short section on scope usage.

electronic music and audio/video

MOBILE DISCOTHEQUE HANDBOOK
G0093B *$4.95*
Most people who start mobile discos know little about equipment or what to buy. This book assumes no preliminary knowledge and gives enough info to enable you to have a reasonable understanding of disco gear.

ELECTRONIC MUSIC CIRCUITS
G0126P *$26.95*
How to build a custom electronic music synthesiser, outlines numerous other circuit designs and then shows you how to modify them to achieve particular responses. Many of the circuits can be used as special-effects boxes for guitars and other musical instruments.

INTRODUCTION TO ELECTRO-ACOUSTIC MUSIC
G0127P *$15.95*
This book assumes no previous technical knowledge. It discusses the relationship between the technology and the composition of electro-acoustic music.

SOUND-SYSTEM ENGINEERING
G0129P *$35.50*
Dealing with audio systems as a whole, it includes installing and equalising the sound system and interfacing the electrical and acoustic systems. Instrumentation, the acoustic environment and designing for acoustic gain.

TUBE SUBSTITUTION HANDBOOK
G0130P *$8.75*
Complete, accurate, up-to-date guide to direct substitutes for receiving and picture tubes. Contains more than 6000 receiving tube substitutes, 4000 monochrome and colour picture tube substitutes, and 600 communications substitutes. Also includes pinouts for quick operational checks.

HOW TO BUILD SPEAKER ENCLOSURES
G0131P $9.50
A guide to the 'whys' and 'hows' of constructing top-performance loudspeaker enclosures.

VIDEO TAPE RECORDERS
G0132P *$21.25*
In this completely revised second edition, the author tells in simple language how helical VTRs work and how to operate and service them. Includes numerous examples of circuits and mechanical systems.

computers for beginners

BIG THINGS FROM LITTLE COMPUTERS
H0142P *$19.25*
A layperson's guide to personal computing with all the basic information and lots of examples of how personal computers can be used.

BEGINNER'S GUIDE TO MICROPROCESSORS AND COMPUTING
H0143B *$6.95*
Introduction to basic theory and concepts of binary arithmetic, microprocessor operation and machine language programming. Only prior knowledge assumed is very basic arithmetic and an understanding of indices.

A MICROPROCESSOR PRIMER
H0144B *$5.95*
Learning about microprocessors is easy with this book, written in a style that is easy to follow. The shortcomings of this basic machine are discussed and the reader is shown how these are overcome by changes to the instruction set. Relative addressing, index registers follow as logical progressions.

AN INTRODUCTION TO BASIC PROGRAMMING TECHNIQUES
H0145B *$6.75*
Ideal for beginners seeking to understand and program in BASIC. Includes program library for biorhythms, graphing Y against X, standard deviations, regressions, generating musical note sequences, and a card game.

BEGINNING BASIC
H0146A *$24.95*
Intended for beginners with no computing experience, one should be able to intelligently program in BASIC in a short time.

UNDERSTANDING COMPUTERS
H0148A *$20.95*
For people who use small computers, this book starts with the most elementary gates and works up to the complete computer. Gives an understanding of the languages and how they operate in the computer.

YOUR FIRST COMPUTER
H0271A *$15.25*
An easy-to-understand beginner's book to small computers. Understanding them, buying them and using them for personal and business applications.

HART'S DICTIONARY OF BASIC
H0276J *$15.75*
Contains more than 800 entries which summarise the actions of almost every statement, command or function you are ever likely to meet. Each entry is explained in plain English, not computerese.

MODERN COMPUTER CONCEPTS
H0313P *$29.95*
The second volume in this series (following ETI Book Sales No. H0312P) covers subjects such as semiconductor memory devices, central processor units, magnetic memories, datacommunications, computer networks and videotex.

computer hardware and techniques

THE 6809 COMPANION
J0154B *$6.95*
This is not a beginner's introduction to microprocessors in general but a discussion of the features of the 6809 and a reference.

IAPX 88 BOOK
J0162P *$20.25*
This book from Intel itself describes the unique Intel 8088 microprocessor in total detail. Invaluable for all involved with the 8088.

INTERFACE PROJECTS FOR THE TRS-80 (MODEL III)
J0203P *$19.25*
This practical manual describes how TRS-80 Model III users can better utilise their micros. Written for the TRS-80 user with some computer experience, it provides a series of easily built interface projects that enable the user to discover the computer's capabilities as each project is constructed.

APPLE INTERFACING
J0273P *$15.95*
Using this book, you will be able to perform useful experiments which will provide a much clearer understanding of the fundamentals of computer interfacing and computer electronics.

8080A MICROCOMPUTER INTERFACING AND PROGRAMMING
J0302P *$23.25*
Second edition of this valuable reference book introduces you to the 8080, probably the most widely-used microprocessor chip. Teaches the fundamental tasks of microcomputer interfacing, discusses polled operation and interrupt operation, and much more.

HOW TO PROGRAM AND INTERFACE THE 6800
J0303P *$20.75*
An in-depth introduction to microprocessors and microcomputers in general and the Motorola 6800 microprocessor family in particular. Includes experiments for the Heath ET3400 and Motorola MEK6800D2 learning systems designed to demonstrate 'real world' applications. Limited supplies.

TRS-80 INTERFACING — BOOK 1
J0306P *$14.75*
An introduction to the internally generated signals available to the TRS-80. It also shows how to use them under BASIC language program control and control external devices. Assumes a good understanding in Level II BASIC.

TRS-80 INTERFACING — BOOK 2
J0307P *$15.75*
Advanced interfacing techniques for the TRS-80. Shows how the computer can be used to drive high-current and high-voltage loads, generate voltage and current signals and more. Includes a chapter on serial communication and remote control.

REAL-TIME CONTROL WITH THE TRS-80
J0325P *$19.25*
How to plan and develop a real-time datalogging or control system and avoid the pitfalls. Includes a detailed case example of the development of a real-time control system, with programs.

THIS MONTH'S SPECIAL

FIFTY BASIC EXERCISES

Normally $17.95; this month only,

$13.25

Designed to teach BASIC through actual practice, this book contains graduated exercises in maths, business, operations research, games and statistics. The programs were designed to run directly on a TRS-80 but will run on any system with MicroSoft BASIC. To order, quote book number KX188A.

Limited supplies

MC68000: 16-BIT MICROPROCESSOR USER'S MANUAL
J0328P $20.80
In this third edition, Motorola offers the latest information to design engineers, software architects and computer designers in order to complete software systems using Motorola's MC68000 microprocessors.

Z8000 CPU USER'S REFERENCE MANUAL
J0337P *$17.95*
Though written as a manual for Zilog's Z8000 microprocessor, this text is also applicable to the Z8001 and Z8002 microprocessors. Includes overviews of architecture, address spaces, CPU operation and external interfacing.

CIRCUIT DESIGN PROGRAMS FOR THE APPLE II
J0403P *$23.75*
A series of ready-to-run Apple II programs ideal for elecronics design engineers, and others, faced with solving problems related to plotting and verification of experimental data.

computing software

HOW TO GET STARTED WITH CP/M
K0174A *$22.95*
This practical book eases the reader into the essentials of the system, giving an overview of the operating system, an idea of what it will be like to use and what it can do for the reader.

INTRODUCTION TO STRUCTURED FORTRAN
K0194A *$21.95*
Written for the beginner, the text incorporates the Fortran 77 with a discussion of structural programming. Includes a discussion of timesharing, pseudo-language programming and WATFIV statements.

APPLE II ASSEMBLY LANGUAGE
K0195P *$23.45*
Teaches assembly-language programming at the beginning level — no prior knowledge of 6502 assembly language is needed. Includes hands-on computer exercises and experiments, with both software and hardware. Provides interfacing circuits and programs that can be used on the Apple II without modification.

INTRODUCTION TO TRS-80 GRAPHICS
K0202A *$22.95*
It begins with the basic concepts of line drawing and leads the reader on to geometric shapes, moving figure animation and other more advanced topics.

MOSTLY BASIC: APPLICATIONS FOR YOUR TRS-80 — BOOK 1
K0204P *$19.25*
28 ready-to-use BASIC programs which have been completely tested and debugged. Programs include a telephone dialler, digital stopwatch, spelling test, house buying guide, gas mileage, and others. Complete with explanations of each program, sample runs, and complete program listing.

MOSTLY BASIC: APPLICATIONS FOR YOUR TRS-80 — BOOK 2
K0205P *$19.25*
32 ready-to-run BASIC programs, including two to test your ability in history and maths, a Dungeon of Danger that's strictly for fun, 11 household programs, seven on money and investment, two to test your ESP level, and more. Complete with explanations, sample run and listing for each program.

amateur radio, dx communications

COMPUTERS AND THE RADIO AMATEUR
N0249P *$31.25*
For the radio operator who wants to know how computers function and how they can be used with other equipment.

LONG-DISTANCE TELEVISION RECEPTION (TV-DX)
N0250B *$6.95*
Written by the British authority, the book includes many units and devices made by active enthusiasts. A practical and authoritative introduction this unusual aspect of electronics.

HANDBOOK OF RADIO, TELEVISION, INDUSTRIAL AND TRANSMITTING TUBE AND VALVE EQUIVALENTS
N0251B *$3.95*
The equivalents book for amateurs and servicemen. More than 18,000 old and new valves from United States, Britain, Europe, Japan. CV (military) listings with commercial equivalents included.

RADIO STATIONS GUIDE
N0252B *$5.95*
An aid for all those who have a radio receiver. Shows the station site, country, frequency and/or wavelength, as well as Effective Radiation Power of the transmitter and, in some cases, the station's call sign as well.

AN INTRODUCTION TO RADIO DXING
N0253B *$6.75*
One section is devoted to amateur brand reception and the other section covers broadcast band reception, with advice on suitable equipment and the techniques employed when using that equipment. The construction of a number of useful accessories is described.

25 SIMPLE AMATEUR BAND AERIALS
N0286B *$6.95*
How to build 25 amateur-band aerials that are simple and inexpensive to construct and perform well. From the simple dipole up to a mini-rhombic.

THE BASIC BOOK OF HAM RADIO
N0287R *$5.75*
A comprehensive guide to the world of amateur radio.

SOLID-STATE BASICS FOR THE RADIO AMATEUR
N0290R *$5.95*
Thorough treatment of the use of solid-state devices. Provides a wealth of tried and proven circuitry, plus practical application data.

TRANSISTOR RADIO SERVICING COURSE
NO309P *$13.95*
A complete course in transistor radio servicing. All aspects of the radio are discussed, section by section, for both AM and FM receivers.

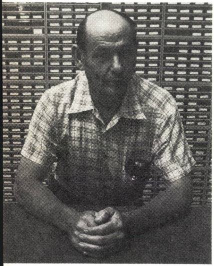
All prices of publications in this catalogue listing are subject to change without notice.

OVER THE COUNTER

This occasional column introduces readers to those people on the other side of the counter in the electronics retail business — where you buy your equipment and component requirements. It serves to 'put a face' to the people who own and run the businesses you may deal with in the course of your job or pursuing your hobby, and to give some background on the business itself.

Geoff Wood Electronics

656A Darling St, Rozelle NSW 2039
(02) 810-6845



DUR FIRST 'Over The Counter' column
ocussed on one of Sydney's long-estab-
ished electronics retailers, so it's appro-
oriate that this, the second, column should
oeam in on Sydney's newest — Geoff
Vood Electronics.

Following the trade trend to name the
ousiness after yourself, you know — Dick
Smith, Rod Irving, etc, Geoff Wood really
xists. (Akwon Streszlecki — forget it).

Geoff opened for business in early
December last year following a distin-
uished career behind the counter at
Radio Despatch Service, unarguably Syd-
ey's *oldest* electronics retail establishment
nd a veritable institution, and a short
tint in the components division of STC-
Cannon. Many Sydney electronics engi-
eers, technicians, servicemen and hobby-
sts would know Geoff from RDS. A
eritable legion of trade reps know him,
oo.

The major speciality of Geoff Wood
Electronics is *semiconductors.* In fact,
vhen you go into the shop you can hardly
ee Wood for the chips! Geoff has in-
talled a 'file' of capstan drawers about
wo metres high by four metres long and
tocked it with a positively *enormous* vari-
ty of semis, particularly National Semi-
onductor products, but also devices from
Fairchild, Philips, Motorola and NEC.
And there's more to come, so he tells us.
He has positively the biggest array of
emis seen North of the Goulburn River.
(Only Melbourne electronics stores ever
ooked like this — Sydney has been un-
derprivileged for years).

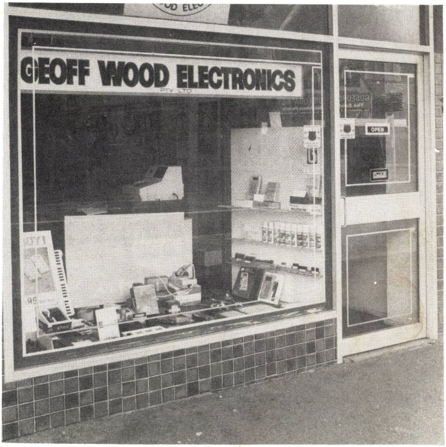
But don't stop at the semis. Geoff
tocks relays, resistors, rotary pots, slider
oots, capacitors and data books, plus
uses, fans, ferrites and fishing gear. (He keeps that out the back; for private use when the tailor are running and the tide is right).

There's too much to mention individually, but we should mention a few of the more unusual items ('cos you all know about the common-or-garden bits). Geoff can supply low voltage metallised poly capacitors in a variety of values (see Shoparound, ETI December '83, page 148). These useful devices are much smaller than your conventional poly capacitors and much more suited to pc board mounting. They also exhibit low self-inductance and are good for critical audio, RF and bypassing applications.

In semis, Geoff can supply those hard-to-get precision op-amps, like National's LH series and stripline-opposed-emitter (SOE) stud-mount RF power transistors. And LEDs — you wouldn't believe the variety of LEDs: Fat ones, skinny ones, red ones, green ones, clear ones, multicoloured types and flashers (whoopee doo!). Then there's relays. If you're looking for an unusual relay to do a difficult task — ask Geoff. If he doesn't have one or can't get one he'll just as likely tell you — who else to ask!

Geoff Wood Electronics' shop was a little bare when we went in to inspect it — but there are more small bits there than we'd like to count on a rainy day, and he has plans for more to come. If he hasn't got them already, he'll soon be stocking project pc boards, too. His old mate Ian Pogson (funny — seem to know that name from *somewhere!*) helps out and many a familiar face from the trade can be spotted in there almost any week. Always affable, Geoff is willing to give advice and assistance where he can.

So, if you're after that 'off-beat' chip or component, or just run-of-the-mill stuff, call in and check out Geoff Wood Electronics. The shop is located in Darling St, Rozelle, on the eastern side of Victoria Road, one block down from the intersection near the corner of National St (auspicious that, as he's a National Semiconductor specialist). If you can't call in, he does mail order too. ●



Mail Order . . . Promark Distributors *. . . Mail Order*

Your First Choice for High Technology Electronic Components
(Founded 1976)

COMPUTER GRADE ELECTROLYTICS

Metal can top screw terminals, High Current includes clamp and screws. Made by Siemens and Marcon.

10,000/16V	$ 5.75	3,300/40V	$ 5.50	4,700/63V	$ 6.50
47,000/16V	$13.25	4,700/40V	$ 6.45	10,000/63V	$12.25
100,000/16V	$18.50	10,000/40V	$ 8.85	10,000/100V	$18.50
10,000/25V	$ 6.60	15,000/40V	$12.25	880/350V	$15.85
22,000/25V	$11.25	22,000/40V	$14.25	3,100/450V	$75.85
33,000/25V	$13.50	47,000/40V	$25.50		
47,000/25V	$17.50	22,000/50V	$13.50		

TELEDYNE I.C.'S.

3½ digit LCD DVM IC TSC7106	$16.50
3½ digit LED DVM IC TSC7107	$16.50
12 bit CMOS A/D for uP TSC7109	$19.50
4½ digit CMOS DVM IC TSC7135	$22.50
4 digit LCD driver TSC7211	$10.50
4 digit LED driver TSC700	$ 8.65
Superlow power 3½ digit LCD DVM TSC7126	$19.50
Dual power MOSFET driver TSC450	$ 4.95
15 bit CMOS A/D TSC800	$35.50
Ultra linear VCO TSC9400	$ 6.45
Stable VRef 1.22V TSC9491	$ 2.45
Super stable VRef 5V TSC9495	$ 7.70

OPTO ELECTRONICS

Siemen's and Optron

LED'S, PHOTOTRANSISTORS & DIODES

Hi-Power IR LED LD271A	$0.75	(A)
Super-Power IR LED 600mW Peak OP290	$2.25	(A)
Narrow Beam 6° IR LED SFH400	$3.35	(A)
Submin IR LED LD261	$1.00	(C)
Phototransistor BP103	$1.10	(A)
Submin Phototransistor BPX81	$1.65	(C)
IR Photodiode Flat Pack BP104	$2.35	(F)
Photodiode VIS + IR with lens OP903	$9.85	(D)
Luxmeter Photodiode BPW21	$12.75	(B)
4 Quad Photodiode for optical trackers SFH204	$25.50	(E)

DISPLAYS

4 digit + driver DL1416	$36.00	(M)
4 digit lge. + driver DL2416	$45.00	(M)

7 SEGMENT HI-BRIGHTNESS 13.5 MM

Red common anode HD1131R	$1.70	(O)
Red common cathode HD1133R	$1.70	(O)
Green common anode HD1131G	$2.05	(O)
Green common cathode HD1133G	$2.05	(O)

OPTOCOUPLERS

Telecom modem type SFH601	$2.30	(J)
Gen. purpose 4N25	$0.95	(J)
Gen. purpose 4N26	$0.95	(J)
Darlington 4N32	$2.15	(J)
Darlington 4N33	$1.50	(J)
Darlington 4N35	$1.10	(J)
Dual ILD74	$2.75	(K)
Quad ILQ74	$6.35	(I)
200V collector OPI6100	$1.65	(J)
10KV isol OPI110	$4.85	
Triac driver OPI3020	$1.95	(J)

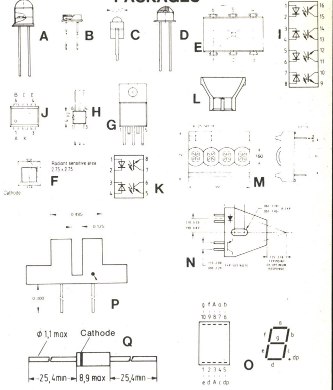
OBJECT SENSORS

Interruptor OPB813	$3.50	(P)
Reflector OPB708	$3.75	(H)
Mirror reflector B141	$0.25	(L)

SIEMENS MICROPROCESSOR & MEMORY

HYB4164P2 64K DRAM	$8.50
SAB8085 CPU	$8.50
SAB8155 RAM + 10	$9.00
SAB8086 CPU	$28.50

PACKAGES

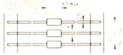


SIEMENS COMPONENTS DATA BOOK 1983

This fantastic book has 600 pages of data on the SIEMENS range of semi-conductors, capacitors, ferrites, relays, thermistors, magneto detectors and all manner of exotic devices.

Really GREAT value at $10.00 (includes postage)

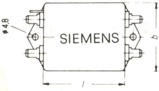
SUBMIN R. F. CHOKES



ALL VALUES 50c

2.2 Microhenry
3.3 Microhenry
4.7 Microhenry
10 Microhenry
22 Microhenry
33 Microhenry
47 Microhenry
100 Microhenry
220 Microhenry
330 Microhenry
470 Microhenry
1 Millihenry
3.3 Millihenry
4.7 Millihenry

PROTECT YOUR DATA WITH THE PROMARK PULSE PRUNER



The PROMARK PULSE PRUNER is a high energy metal oxide varistor and a multi-element balanced LC line filter which work together to clip spikes and hold back RF interference. These are a must for computer power inputs — Also great for Hi-Fi's to keep out taxi's, CB's, etc., from your Wagner & Strauss.

Rated 240V —4 AMP
$22.50

SIEMEN'S T092 TRANSISTORS

SPECIAL!

All 10c each

BC547
BC548
BC549
BC550
BC556
BC557
BC558
BC559

SPECTROL TRIMMERS, POTS AND DIALS

¾" rectangular 20 turn cer. met type 43P 100R, 200R, 500R, 1K, 2K, 5K, 10K, 20K, 50K, 100K, 200K, 500K, 1m	all $1.50
⅜" single turn cer. met type 63P, 50R, 100R, 500R, 1K, 2K, 5K, 10K, 20K, 100K, 1M	all $0.85
Precision 10 turn wire-wound pot type 534, 500R, 1K, 2K, 5K, 20K	all $10.50
100K	$17.50
3 digit dial to suit 534, mod 15	$25.50

I.C. SOCKETS

Burndy type DILB pcb mounting tin plated mil. spec.

8 pin	13¢	18 pin	28¢	24 pin	36¢
14 pin	20¢	20 pin	30¢	28 pin	40¢
16 pin	25¢	22 pin	33¢	40 pin	60¢

E.C. POWER FERRITES

Includes 2 corehalves, bobbin and clamp

EC35	$2.95	EC52	$5.35
EC41	$3.95	EC70	$8.45

FUJI POWER RELAY — *SPECIAL!*

2 changeover, 10 amps per contact — 240 AC.

12V type HH62P12V	$4.45	24V type HH62P24V	$4.45

SIPMOS N CHANNEL POWER FETS

BUZ10-50V/12A	$9.25	BUZ15-50V/37A	$32.50
BUZ20-100V/12A	$9.25	BUZ23-100V/10A	$12.35
BUZ30-200V/7A	$7.30	BUZ24-100V/32A	$23.70
BUZ80-800V/2.6A	$15.50	BUZ84-800V/5.3A	$33.75
BUZ40-500V/2.5A	$7.30	BUZ18-50V/37A	$37.95

SCR'S TO 220 PACK		TRIACS	
C1053M 800V 6A	$1.32	XD10K70 8A 700V	$1.68
D1046M 700V 10A	$1.32	XC10H70 6A 700V	$1.44

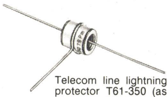
SIEMENS LEDS

We have an enormous range of SIEMENS coloured LEDS, red, yellow, green, orange, from 1 mm diameter to 3 mm and 5mm types, round, square, rectangular, triangular, arrow, pointer, bar graph, two-colour, auto-flashing. Too numerous to list here. Send large S.A.E. for LED catalogue.

TUBULAR SOLID TANTALUM CAPS

MILITARY GRADE CSR13

2.2µF/35V	$0.50
3.3µF/35V	$0.50
6.8µF/35V	$0.50
47µF/6V	$0.50
100µF/10V	$1.75



Telecom line lightning protector T61-350 (as seen on 60 Minutes) $8.00

SIEMENS MINIATURE PCB RELAYS 1 AND 2 CHANGE OVER

Contacts 1 Amp, max voltage 120AC, plugs in IC socket.

1 c/o 6V type 6V103	$2.10
1 c/o 12V type 12V103	$2.10
1 c/o 24V type 24V103	$2.10
2 c/o 6V type 6V104	$3.25
2 c/o 12V type 12V104	$3.25
2 c/o 24V type 24V104	$3.25

SPECIAL IC'S FROM SIEMENS

Light spot driver 16 LEDS UAA170	$3.85
Light band driver 12 LEDS UAA180	$3.85
3 Tone chime SAB0600	$6.60
Touch dimmer IC S576A	$7.65
AC motor speed controller TLB3101	$5.50
Long period timer SAB0529	$7.00
Linear magnetic field detector SAS231W	$7.00 (H)
Switch-mode driver IC TDA4718A	$9.95
8 Chan remote control TX SLB 3801	$7.35
8 Chan RX SLB3802	$9.95
VHF mixer S042P	$4.65
IGHZ divide by 64 prescaler SDA2101	$7.95
Photo sensitive amp TFA1001W	$4.85 (H)
IR photo-preamplifier TDA 4050	$4.85
Metal detector IC TCA205A	$4.65
Pot core + bobbin for TCA205A	$0.85
14 Watt audio amp TDA2030	$5.95 (G)
AM radio IC mw-sw TDA1046	$8.75
FM radio control RCVR IC S1469	$9.20
FM IF + demodulator TDA1047	$5.60

!SPECIALS!

5W ZENERS
5.6V $0.50
12V $0.50 (Q)

Super Bright Red LED
CQV51-H (150 mcd) $0.40 (A)

Hi-Power IR LED
LD242 (30mW output) $0.85 (D)

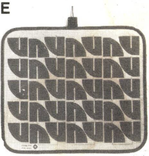
!SPECIAL!

Little Big Board
(Includes sockets for all IC's)
$422.00
No discount on this item.

!SPECIAL!

SOLAR POWER MODULE

The ARCO solar type M82 is a compact 36 cm x 31 cm array providing open circuit 20V and short circuit 600mA.
This unit is ideal for 12V battery charging for boats, caravans, etc. It can also be used for powering pumps, radios, electric fences, beacons, etc. Made in U.S.A.



Price . . . $260.00
(No discount on this item)

ALL COMPONENTS OFFERED ARE BRAND NEW, PREMIUM GRADE DEVICES. **SALES TAX IS INCLUDED** FREIGHT CHARGE IS $3.50 PER ORDER. IF YOU REQUIRE DATA AND APPLICATIONS ON ANY ITEM SEND A STAMPED SELF-ADDRESSED ENVELOPE.

D.I.S.C.O.U.N.T.S. . . . TOTAL ORDER VALUE . . . up to $50 NETT; $50 to $100, less 10%; $100 and over, less 15%.

P.O. BOX 381 CROWS NEST N.S.W. 2065. PHONE (02) 439 6571

BANKCARD WELCOME

(No discount on B/Card Sales)

Train at Home for a Better Career

Choose from 34 opportunities!

Now without attending school or university, without any previous experience, you can train at home in your spare time for a money making career . . . even obtain a Career Diploma. Send for free facts about the exciting programme that interests you most. Mail coupon today and you will receive complete information that shows you how easy it is to qualify for a great new career or advancement in your present job.

SEND FOR FREE FACTS!

ICS Since 1890

International Correspondence Schools
400 Pacific Highway, Crows Nest
NSW 2065

YES! Please send me without cost or obligation free facts on how I can study at home for the career I have chosen.

TICK ONE BOX ONLY!

- ☐ Personal Computing
- ☐ Computer Programming
- ☐ Business Management (IBA)
- ☐ Executive Management
- ☐ Small Business Owner
- ☐ Refrigeration/Air Conditioning
- ☐ Practical Accounting
- ☐ Management Accounting
- ☐ A.C.I.S. Coaching
- ☐ Hotel/Motel Management
- ☐ Restaurant and Catering Management
- ☐ Auto Mechanic
- ☐ Motorcycle Maintenance
- ☐ Building
- ☐ Builder's Draftsman
- ☐ Drafting
- ☐ Architectural Assistant
- ☐ Electronics
- ☐ TV Technician
- ☐ Sales/Marketing (AMI)
- ☐ Civil Engineering
- ☐ Electrical Engineering
- ☐ Mechanical Engineering
- ☐ Pharmacy Assistant
- ☐ Secretarial
- ☐ Business Communication
- ☐ Recreational Art
- ☐ Commercial Art
- ☐ Photography
- ☐ Interior Design
- ☐ Guitar
- ☐ Commercial Writing
- ☐ Short Story Writing
- ☐ Dressmaking

001

Mr/Mrs/Miss ____________________

Address ____________________

____________ P/code ________ Phone (Home) ____________

Tick Here if Full Time Student ☐ 0712

Ian J. Truscotts

ELECTRONICS WORLD

For all your Electronic needs

- KITS
- COMPONENTS
- TOOLS ETC.

Resellers of Dick Smith, Alltronics

Call in and browse around

Cnr. Bayswater & Eastfield
South Croydon

Phone
723 3860

Matsunaga

Automatic Voltage Regulators and Slide Regulators

NEW

Stabilised AC power supply

Precision manufactured, accurate and efficient. Matsunaga automatic voltage regulators offer rapid voltage correction with zero waveform distortion. The units are of robust but compact and lightweight construction and are ideal for applications where constant voltage is important.

AC AUTOMATIC VOLTAGE REGULATOR
MODEL SVC-1000N
Matsunaga Manufacturing Co. Ltd.

Models — SVC, 350 N, 1000 N

Input Voltage: 180V to 260V AC.

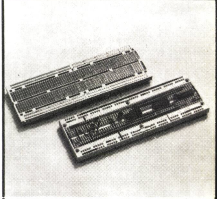
Output Voltage: 110V to 240V ±3% (simultaneous output) Single Phase 50-60 Hz.

Prices: 350VA $141.00, 1000VA $252.00 (plus Sales Tax if applicable).

Quantity discounts available.

Electromark Pty. Ltd.,
43 Anderson Road,
(P.O. Box 184)
Mortdale. NSW 2223

REDESIGNED AND IMPROVED SK-10



LIFETIME GUARANTEE!

- New Body Material (capacitance 3.5pF rail to rail)
- Numbered contacts (840 contact points)
- Current capacity 4 amps
- Resistance 2.5 contact to contact
- All component sizes 20-26 AWG
- Also available:
  — SK-50 Halfboard (430 contacts)
  — SK-20 Miniboard (80 contacts)
- **Lifetime guarantee**

"We will replace, free of charge, any E & L Breadboarding socket which fails to meet specifications or which breaks down in the course of normal usage."

Available throughout Australia from:

VIC:	Stewart Electronics (03) 543 3733
SA:	Graphic Electronics (08) 42 6655
WA:	Reserve Electronics (09) 328 9755
QLD:	Fred Hoe & Sons (07) 277 4311
NSW:	E.D.S. (02) 438 2500
	MACELEC (042) 29 1455
	D.G.E. (049) 69 1625

ELECTRONIC DEVELOPMENT SALES PTY LIMITED

92 Chandos Street, St Leonards
NSW Box 217 St Leonards 2065

Tel: (02) 438 2500
Tlx: AA 25963

RF SPECTRUM USAGE CHART PUBLISHED BY D.O.C.

The Department of Communications has produced a colour-coded chart showing complete use of the radio frequency spectrum in Australia.

The chart reflects information set out in the *Australian Table of Frequency Allocations* publication, which in turn is based on the International Telecommunication Union (ITU) Radio Regulations.

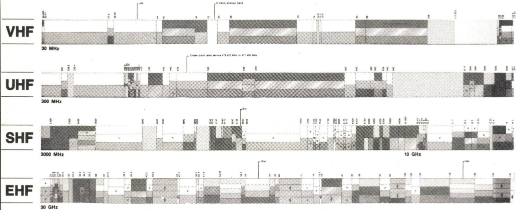
"The new chart provides a quick and easy-to-read guide to Australia's increasingly congested frequency spectrum," a spokesman for the Department said.

"Over the last decade the demand placed on the frequency spectrum has meant that new areas have had to be utilised, such as Ultra High Frequency (UHF) for television. The guide shows the full range of frequency bands from Very Low Frequency (VLF) to Extremely High Frequency (EHF).

"Each of these bands is divided into sub-bands which are used by particular services such as land-mobile radio, broadcasting, aeronautical, maritime or space services. The spectrum used by different services is shown in the chart by different colours.

"All those using the radio frequency spectrum, from broadcasting stations to amateurs, will find the chart a very useful reference guide."

The chart is available from **Australian Government Publishing Service** outlets in all the capital cities for $3.



A section of the chart showing the Australian Table of Frequency Allocations.

'6UP', THE VHF/UHF ENTHUSIASTS' MAGAZINE RETURNS

The 'boom' years for VHF/UHF activity in Australia were the early 1970s — the period when SSB 'took over' the lower end of six and two metre bands and the Great FM Repeater Debate raged.

Many local VHF group newsletters flourished then, but the only national newsletter in that period was '6UP' (an acronym for 'six metres and up', six metres being the 'lowest' of the VHF/UHF amateur bands).

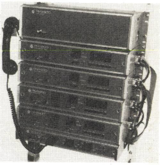
Always practical, occasionally controversial, 6UP was avidly read by *every* active VHF/UHF enthusiast then. Over 30 issues were published between 1971 and 1975. Its passing was sorely missed. it was edited by Val & Roger Harrison VK2ZTB.

Now the wheel has turned full circle and another boom in VHF/UHF activity has arisen — but where are the newletters for the enthusiast?

6UP returns! The all-new, singing-dancing, lemon-fresh, fully-revived 6UP is to reappear as a quarterly, beginning with a bumper issue in March. It will be published by Andrew Kay VK2YLA, of Teknidata Services, with Roger Harrison VK2ZTB as Consulting Editor.

The first return issue will have 'Antennas & Propagation' as its theme, covering moonbounce to meteor scatter, quad-yagis to collinears. Many of the articles are 'classics' from the earlier issues (still much in demand), but there's fresh material, too. Quality production is the aim, with the aid of a word processor and printer, with properly draughted illustrations.

Cover price of the first return 6UP is to be $3.50, plus 90 cents post and handling. Enquiries to **Teknidata Services, PO Box 844, North Sydney, NSW 2060.**



LOS RADIOS

AWA has just released the RMA 900, a microwave, analogue, line of sight (LOS) radio system for carrying telephone, telex, television, data and other communications signals in rural and outback areas.

AWA says the RMA 900 is ideal for mining companies and other organisations needing reliable communications over long distances in country locations. LOS systems can transmit signals over distances stretching thousands of kilometres.

Telecom has initially ordered 200 of the radios, mainly for transmitting telephone communications in the rural areas of several States.

Each of the RMA 900 radio systems carries up to 72 telephone channels and has 1400 frequencies in the 820 to 960 MHz band.

AWA is manufacturing two versions of the 900. The basic model consists of a receiver, transmitter and a diplexer or signal separator connecting the transmitter and receiver on to one antenna.

This model is an unprotected terminal radio so if the signal fails, 'in-the-field' repairs must be made to restore communications.

But the protected terminal version has two receivers and transmitters. If the main transmitter or receiver fails, the second transmitter or receiver automatically switches over to continue the transmission.

Unlike its previous LOS systems, the 900 can have its frequencies changed by simply opening up the modular cabinet and flicking the switches inside.

On other LOS radios, replacement quartz crystals are needed when tuning to a new frequency.

For further information contact **Amalgamated Wireless (Australasia) Ltd, North Ryde Division, Cnr Talavera and Lane Cove Rds, North Ryde NSW 2113. (02)887-7111.**

"10-OVER 50% OFF SALE"

MULTIMETER (FANTASTIC)

- Fuse/diode protected
- 4mm Banana socket probes!
- Bifurcated selector switch contacts!
- ABS impact-resistant case!
- Large! Measures 90(w)x135(h)x45(d)mm

SPECIFICATIONS:

DC	AC
0 - 0.25	0 - 10
0 - 10	0 - 50
0 - 50	0 - 250
0 - 250	0 - 1000
0 - 1000	
20,000 ohms/V	9,000 ohms/V
RESISTANCE	DC CURRENT
0 - 5k	0 - 0.05
0 - 50k	0 - 25
0 - 500k	0 - 250mA

dB -20 to «22dB
BATTERY CHECK FACILITY - AA, C & D CELLS
Accuracy DC #3% F.S. - AC #4% F.S. OHMS #3%
BANANA PLUG PROBES AND BATTERY INCLUDED

This is an unbelievable meter bargain. Normally this unit would sell for around $25. Japanese made quality.
Cat. QM-1005

NORMALLY $17.95

THIS MONTH

$14.95

SAVE WELL OVER 10%

BT-151-650R

This is the 650 volt version (for extra safety) of the C122E SCR which we use in the popular 'Fluorescent Lamp Starter' kit as described in October 1982 EA. Normally $1.50 each. This month only 95¢ each! (Minimum 5 pieces). Makes the Fluoro starter kit very cheap!
Cat. ZX-7022
(PCB's for the kit) Cat. HP-8747 ONLY $1.95)

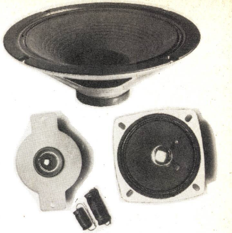
(3 amp 650V SCR)

ONLY 95¢ each (min 5)

LOW COST HI FI
SAVE $5 - A FURTHER 20%

Each kit contains a massive 10" (250mm) woofer, cone midrange and DOME tweeter!! You also get, at no extra charge, the special crossover capacitors!
The system is rated at approximately 20 watts RMS so it is ideal as an economical but reasonably powerful main Hi Fi unit or as a second system for another room or outdoors.
Each 3-way kit comes with a recommended enclosure design which you can build yourself easily!
You would normally pay well over $60 for the equivalent from major kit speaker suppliers so this is an outstanding bargain.
Sensitivity of the system is 93dB/1m/1 watt.
Cat. AK-3700

3-WAY SYSTEM NORMALLY
$24.95 a set NOW $19.95



Woofer not to
same scale as
other components

AMAZING VALUE
2 SETS FOR STEREO (6 spkrs)
NORMALLY $39.95
NOW $34.95

UHF AMPLIFIER SENSATION

AMATEURS PLEASE NOTE!

UP TO 25% OFF!!

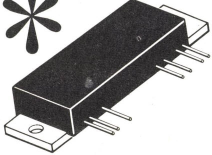
SAVE A FURTHER $10!

NORMALLY $39.95

FEB ONLY

$34.95

10 UP PRICE FOR CLUBS
$29.95 EACH



Jaycar has purchased a quantity of genuine Brand New MOTOROLA Brand MHW-710-1 UHF Power Amplifier modules. These units are designed for industrial and commercial FM transmitters!
The unit (pictured) is a rugged, tuned train of RF Power Amplifier transistors featuring thin film gold metal metallization, laser trimmed Nichrome resistors and MOS capacitors. The MHW-710-1 bolts to any flat surface (metal) to assist heat dissipation.

SPECIFICATIONS:

- RF power out @ 12.5V 13 watts - RF power out @ 15V 17 watts!! (Both of the above ratings are likely to be exceeded as Motorola's power ratings are conservative)
- 19.4dB (Min) power gain. Typical drive level to full power 90-150mW
- Frequency band 400-440MHz. Will work to 450MHz and therefore covers the AUSTRALIAN UHF AMATEUR BAND!!
- Circuit diagrams included.

Each MHW-710-1 comes individually packed with full manufacturers data. A manufacturers recommended circuit is included (only a few external components required), as well as a PCB pattern for the circuit. This component makes an ideal base for a "Home Brew" UHF Linear Amplifier! GREAT for UHF Mobile!

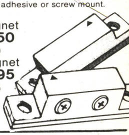
SERVICEMEN
The MHW-710-1 has been used extensively in Australian manufactured UHF Mobile 2-way radios. If you own or service a UHF radio that uses this part, now is your chance to grab a spare at an unrepeatable price! The MHW-710-1 sells for A$68 plus tax in the USA.

QUANTITIES STRICTLY LIMITED
To be fair to all, we have limited this offer to 2 per person. Jaycar's scoop offers are so successful that usually hundreds miss out. Even at 2 per customer we will probably run out quickly. Be early to avoid disappointment!
Cat. ZK-8882

REED SWITCH & MAGNET SETS

Powerful magnet. Self adhesive or screw mount.

N/C Reed & Magnet
Cat. LA-5070 **$2.50**
10 UP **$2.10**
N/O Reed & Magnet
Cat. LA-5071 **$2.95**
10 UP **$2.75**



115 VOLT COMPUTER FANS

We have made a scoop purchase of computer grade Box Fans. They measure a standard 80x80x40mm. But there's a catch! They are only available in 115V!
Great if you are making equipment for export to the USA - or use 2 in series! No problem!
Cat. YX-2508

NORMALLY $14.95

THIS MONTH $12.95

SAVE $2.00 OR OVER 10%

TWIN SCREENED AUDIO CABLE

Twin screened round audio cable. (Two screened conductors NOT fig.8)
This cable normally sells for 40¢/metre or $42.00/roll.
Cat. WB-1504

SAVE OVER 50%

ONLY $20 PER ROLL

SCOOP!

FAMOUS XURON BRAND

Quality U.S. made precision plier at a discount price!!

When we were getting these smooth jawed pliers originally we could not keep up with the demand at $6.95 each.

The importer needed cash and sold us the balance of his stock.

We offer this plier to you for a staggering $3.95! FEBRUARY ONLY!!

Prices *must* go up when new stocks arrive.

Length 130mm. Max jaw opening 20mm.

Special return spring mechanism. U.S. quality at an Asian price!

Cat. TH-1581

Note the soft-grip (orange) handles!

WAS $7.95

NOW ONLY $3.95

SAVE $4.00!!

UNBELIEVABLE!

FAMOUS XURON BRAND

Same story except more amazing! This time stainless steel precision flush-cutting miniature cutters!!

These normally sell to the trade for $11.95 each *plus tax.*

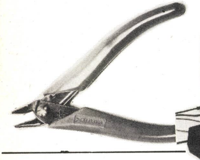
For FEBRUARY ONLY you can grab a pair for

ONLY $4.95 - LESS THAN ½ NORMAL PRICE

- *Compare with more expensive Asian copies!!*
- *Note the blue cushion grips!*
- *Supplied in individual box*

Cat. TH-1585

ONLY $4.95



DPM-50

$39.95

Cat. QP-5512

DPM-200

$49.95

Cat. QP-5510

LCD panelmeters

We have been unable to keep up with demand for these, that is why you have not seen them in our ads for awhile.

DPM-200

3½ digit display with annunciators (pictured). 0.6" high. 200mV full scale. Each unit supplied with data sheet.

DPM-50

(Not illustrated) 3½ digit display with "plus", "minus" and "low batt". Annunciators with 0.5" readout.

Both units sample at 3/second

If you want to express any physical meaurement in a bright easy to read display these are for you. They contain all analogue-to-digital electronics and LCD drive circuitry. Send SAE for more information.

MICROGRASP

The MicroGrasp is the first low-cost true robot. Basically the unit has an articulated arm jointed at the shoulder, elbow and wrist positions. The entire arm rotates on its base and has a motor driven gripper on the end of the arm. Each of the arm movements is SERVO CONTROLLED i.e. there are position sensors feeding back information to the interface board where it is compared with the programmed in intended position. Any positional error is automatically and continuously corrected. This servo action is independent of the computer, simplifying greatly the software to drive the robot. All programming is carried out with a small number of common BASIC commands. The interface board is memory mapped using only 64 Bytes at any of the 1024 switch selectable locations.

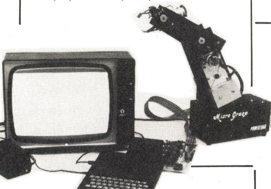
Control of the MicroGrasp as a computer peripheral is accomplished thru the parallel expansion port of most small computers. To keep the cost to an absolute minimum and to increase the learning factor the MicroGrasp is supplied as a self-assembled kit. All components down to the last nut and bolt are included, as is the power supply.

COMPLETE KIT INCLUDING POWER SUPPLY.......... Cat. XR-1000 *$499*

Universal Computer Interface Board (in kit form) Cat. XR-1010 ONLY $179

23 plus 23 way edge connector at $9.95

ZX81 peripheral/RAM pack splitter board $10.95



CA3005 RF AMP MODULE

This useful device is a complete RF amplifier on a chip.

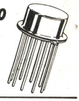
NORMALLY SELLS FOR $6.95

FEB ONLY $2.95

including full data sheet

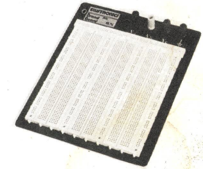
Cat. ZL-3805

SAVE $4.00



STANDARD BREADBOARDS

Cat. No.	No of holes	Price Normally	Price Feb
PB-8810	WBDN 100	$3.45	$2.95
PB-8812	WBTN 240	$10.05	$9.95
PB-8814	WB2N 840	$16.95	$15.45
PB-8816	WB4N 1680	$29.50	$26.50
PB-8818	WB6N 2420	$45.00	$39.95



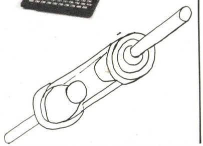
SURGE SUPPRESSOR - THE REAL THING??

This unit is designed to fit on the low volt side of power supplies. It has the capacity to absorb enormous power transient spikes.

- *Ideal for computer conditioning*
- *Power supplies etc.*
- *Similar (but possibly superior) units sell for around $8*

FEB ONLY - LIMITED QUANTITY

$4.00 Cat. RC-5385



Jaycar Incorporating ELECTRONIC AGENCIES

SYDNEY SHOWROOMS

117 YORK STREET – PHONE: (02) 264 6688 and (02) 267 1614

TELEX: 72293

CARLINGFORD

Cnr. CARLINGFORD & PENNANT HILLS ROAD – PHONE: (02) 872 4444

CONCORD

115 – 117 PARRAMATTA ROAD – PHONE: (02) 745 3077

HURSTVILLE 121 FOREST ROAD – PHONE: (02) 570 7000

NUMBER 1 FOR KITS

POST AND PACKING CHARGES

$5 – $9.99 ($1.50)	$10 – $24.99 ($3.20)
$25 – $49.99 ($4.50)	$50 – $99.99 ($6.50)
$100 – $198 ($8.00)	Over $199 ($10)

"Free INSURANCE for Road & Registered Post over $200"

All heavy or bulky items (over 20kg.) sent Comet Road Freight $12.00 anywhere in Australia.

SHOP HOURS CARLINGFORD, CONCORD & HURSTVILLE

Mon – Fri 9am – 5.30pm: Sat – 9am – 12pm: Thurs night 8.30pm

SHOP HOURS SYDNEY

Mon – Fri 8.30am – 5,30pm. Sat – 8.30am – 12pm: Thurs night 8.30pm

MAIL ORDERS AND CORRESPONDENCE: P.O. Box 185, Concord, 2137

Mail Order By

BANKCARD Via Your Phone

CHECK OUR CONCORD STORE FOR SATURDAY AFTERNOON TRADING IN FEBRUARY

A beam heading calculator for the DX enthusiast

Neil Duncan VK3AVK

Here's a simple program to calculate beam headings from your location to any other location specified on the surface of the earth. It's written for the VIC-20 but should be readily translatable to other home computers.

ANYONE who owns a beam antenna for listening to or working DX will at some stage need to find beam headings for a particular area of interest. The usual way of achieving this is to refer to a "great circle" map of the world. In developing that map, an assumption was made as to the central point of the map. At the VK3AVK shack, I have found it particularly annoying to find beam headings which are significantly wrong, because the map from which I took the readings were based on Sydney (which is somewhere to the north of Melbourne).

This program, written for the VIC-20, calculates the beam headings which are needed, based on your own location (QTH). The mathematics involved assumes a great circle path between the two points entered into the program. Rounding error, etc, becomes a problem with bearings which are within one degree of multiples of 90 degrees, but otherwise, the results are very good indeed.

Using it

To use the program, you will need to arm yourself with the following information; the latitude and longitude of your own QTH and that of the various places in which you are interested. The best place to find these is probably a world atlas. You probably have one left from your school days. It will likely be full of amusing things that you wrote, however!

The program requires the entry of your QTH co-ordinates. I found mine to be 37°45′ S and 145°14′ E. Obey the following convention: Latitudes which are *North* of the equator are *positive* numbers, those which are *South* are *negative*. Longitudes which are *West* are positive, those which are *East* are *negative*. So those co-ordinates will be entered as

−37,45 (return)
−145,14 (return)

The comma separating the numbers is essential. To check that your program is working properly, Table 1 gives a few results that the program should produce. They are based on the above QTH.

The error due to the number of significant figures used, will become apparent if you calculate bearings and distances to

Out with old — in with new! Now there's no need to fool around with azimuth-equidistant projections (like that below) that are centred on somewhere other than your location (resulting in incorrect beam headings). Use the program opposite and get beam heading printouts directly. Azimuth-equidistant maps (or Great Circle maps, as they are generally called) also have a problem in that it is difficult to find locations around the outer edge (antipodes) where distortion of the outlines is greatest.

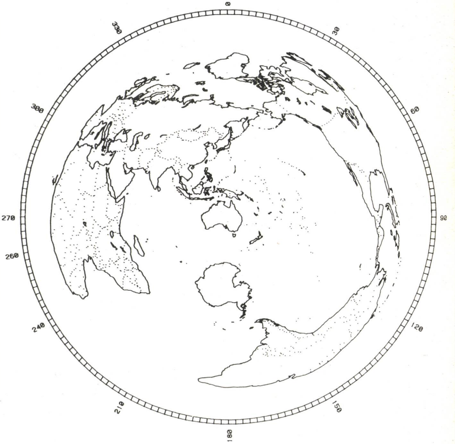


TABLE 1

Place	Latitude	Longitude	Bearing	Distance
Berlin	52,32	−13,25	310°	15984 km
Llullaillaco	−24,43	68,30	148°	12225 km
Leeds	53,50	1,35	316°	16924 km
Mulga Park	−25,50	−131,45	312°	1834 km

places relatively near. VHF operators will need to think further afield. They tend to point their beams up in the air sometimes which won't help, either!

Inspiration in writing this program was gained from an article in *Amateur Radio* magazine (journal of the Wireless Institute of Australia) for April 1982, page 16. ●

```
10  REM GREAT CIRCLES
20  GOSUB 1000
30  DIM A(2,2)
40  FOR I= FL TO 2:FOR J = 1 TO 2
50  PRINT"clear,home,down,down"A$(J)
    B$(I):PRINTC$;
60  PRINT"down(seven times)":INPUT Z1,Z2
    :GOSUB 2000
70  A(I,J)=X1:NEXTJ:NEXTI:FL=2
80  X1=SIN(A(1,1))*SIN(A(2,1))
90 X1=X1+COS(A(1,1))*COS(A(2,1))*
    COS(A(2,2)-A(1,2))
100 X1=SQR(1-X1*X1)/X1
110 X2=ATN(X1):IFX1<0 THEN X2=π+X2
120 D1=6370.15*X2:D2=40212.38-D1
130 X3=SIN(A(2,1))-SIN(A(1,1))*COS(X2)
140 X3=X3/(SIN(X2)*COS(A(1,1)))
150 IF ABS(X3)>.999THEN X3=.999*SGN(X3)
160 X4=SQR(1-X3*X3)/X3:X3=ATN(X4)
170 IF X4<0 THEN X3=X3+π
180 IF SIN(A(2,2)-A(1,2))>=0 THEN
    X3= 2*π-X3
190 IF X3<0 THEN X3=π+X3
200 X3 = X3*180/π
210 X5=X3+180:IF X5>360 THEN X5=X5-360
220 GOSUB 900:GOTO 40
900 PRINT"clear,homeSHORT PATH BEARING"
    INT(X3+.5)"ΔΔΔ(DEGREES)"
910 PRINT"DISTANCE"INT(D1+.5)"KILOMETRES"
920 PRINT:PRINT:PRINT
930 PRINT"LONG PATH BEARING"INT(X5+.5)
    "ΔΔΔ(DEGREES)"
940 PRINT"DISTANCE"INT(D2+.5)"KILOMETRES"
950 PRINT:PRINT"E=END C=CONTINUE";
960 GET Q$:IF Q$=""THEN 960
970 IF Q$="E"THEN END
980 IF Q$<>"C" THEN 960
990 RETURN
1000 A$(1)="LATITUDEΔ-Δ"
1010 A$(2)="LONGITUDEΔ-Δ"
1020 B$(1)="YOUR QTHΔ"
1030 B$(2)="REMOTE QTHΔ"
1040 C$="DEGΔ(COMMA)ΔMINUTES"
1050 FL=1
1060 RETURN
2000 IF ABS(Z1)>360 OR ABS(Z2-30)>30
     THEN FOR L=1 TO 200: PRINT
     "clear,homeBAD DATA":NEXTL:RUN
2010 X1=(Z1+SGN(Z1)*Z2/60)*π/180
2020 RETURN
```

SAWTRON
KG103
SERIES

VHF & UHF HANDY
TRANSCEIVERS

THE SAWTRON KG 103
SERIES FEATURES:-

- THE LATEST THICK FILM HYBRID I.C. TECHNOLOGY.
- MODULAR CONSTRUCTION TECHNIQUES.
- EXCELLENT SENSITIVITY, SELECTIVITY AND BLOCKING.
- RUGGED CONSTRUCTION.

PERFORMANCE AT A
REALISTIC PRICE.

IMARK
167 RODEN STREET,
WEST MELBOURNE.
VIC. 3003
PHONE (03) 329 5433.
TELEX AA37753

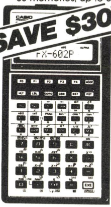
Get the gear for the new tech/school year!

Casio FX-602P Advanced Programmable

The last word in pocket calculators! Programmable scientific calculator ideal for high school and university students, from one of the world's leading manufacturers. Extra thin and will fit in your pocket. Geared to higher mathematics, physics & engineering. 88 memories, up to 512 steps.
Cat Q-3110
WAS $169

SAVE $30

$139



CASSETTE INTERFACE

Get the most from your FX602P with this brilliant addition. Now you can store data, programs, results etc on a standard cassette recorder with the help of this interface.
Cat Q-3125

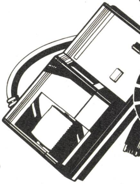
ONLY $52.50

SAVE OVER $20 on this PRINTER UNIT

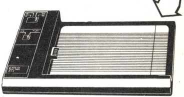
If you want your stored data and/or programs in hard copy form, use this superb add-on printer unit. Was $126.50. Cat Q-3127

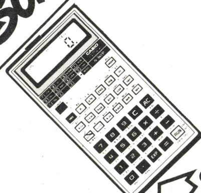
$99

Paper to suit Cat Q-3128 ... $9.50



CASIO QUALITY AT DICK'S LOW PRICES!

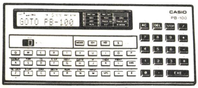




CASIO FX3600P SCIENTIFIC/ PROGRAMMABLE

Ready to handle anything you can give it! The ideal calculator for tech. & university students, engineers, technicians and lab. workers. This Casio calculator has the added advantage of simple programmability, plus Integrals! It has up to 38 step programming capacity with integrals, regression analysis, 7 memories, 10 digit mantissa and 2 digit exponent. Comes complete with wallet and instructions. Cat Q-3105

ONLY $62.50



CASIO HAND HELD COMPUTER

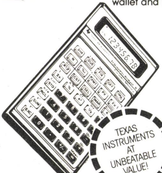
A brand new hand held computer from one of the world's leading manufacturers. The Casio PB100 – learn as you go computer with VLSI CPU equivalent to 150,000 transistors! With 544 program steps and 94 data memories (expandable). 5 x 7 dot matrix 12 digit display and a standard 53 key keyboard.
Cat X-5110

***New model only* $79.95**

1K RAM PACK

Expands the PB100's memory to 1K, programming to 1,568 steps. A must for the serious user. Cat X-5112

***Unbelievable value! ONLY* $40**

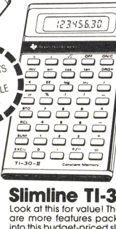


TEXAS INSTRUMENTS AT UNBEATABLE VALUE!

TI BUSINESS ANALYST

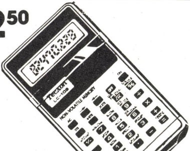
Help relieve the drudgery of many complex calculations that can arise every day. This little business analyst (that lives in your briefcase!) can calculate sales tax & price, monthly payment for mortgages, present value of lease without residue, solving for APR, finding yield to maturity on a commercial bond and lots more. As well it's an LCD memory calculator with auto power down, scientific notation and constant memory.
Cat Q-3785

***and it's only* $57**



Slimline TI-30

Look at this for value! There are more features packed into this budget-priced slide rule calculator than most other manufacturers put into calculators that cost twice the price! Features like LCD, constant memory holds numbers in user memory even while it's turned off, automatic power down shuts calculator off after 5-15 minutes of non-use. There is more! Why not check it out at your nearest store? **$23**
Cat Q-3737



METRIC CONVERSION

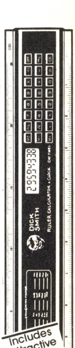
Still having problems with metrics? Let this superb calculator help you. Pocket sized, LCD, converts imperial to metric and vice-versa. Also does the normal functions.
Cat Q-3025

$19.95

Ruler/Calculator & Clock

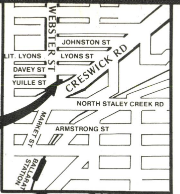
No student should be without one of these. Inside this 1ft/300mm metric/imperial rule is an accurate LCD digital clock & a full function LCD 8 digit memory calculator. Plus there's the added bonus of a metric conversion table on the rule too! And all this for the price of a clock alone! Cat Y-1057

WAS $19.95 SAVE $5 $14.95



Includes attractive protective pouch at no extra cost!

OPENING THIS MONTH IN BALLARAT (VIC.)



CNR. CRESWICK RD. & WEBSTER ST. BALLARAT

WATCH YOUR LOCAL PAPER FOR DETAILS

OPENING SOON IN BENDIGO, EAST BRIGHTON & DARWIN NT.

STORE LOCATIONS

NSW	Cnr. Swift & Young Sts.	**ALBURY**	**21 8399**
	Parramatta Rd & Melton St	**AUBURN**	**648 0558**
	T55 Terrace Level	**BANKSTOWN SQ**	**707 4888**
	613 Princes Hwy	**BLAKEHURST**	**546 7744**
	Oxford & Adelaide Sts	**BONDI JCT**	**387 1444**
	531 Pittwater Rd	**BROOKVALE**	**93 0441**
	147 Hume Hwy	**CHULLORA**	**642 8922**
	162 Pacific Hwy	**GORE HILL**	**439 5311**
	315 Mann St	**GOSFORD**	**25 0235**
	4 Florence St	**HORNSBY**	**477 6633**
	Elizabeth Dr & Bathurst St	**LIVERPOOL**	**600 9888**
	173 Maitland Rd	**NEWCASTLE**	**61 1896**
	Lane Cove & Waterloo Rds	**NORTH RYDE**	**88 3855**
	George & Smith Sts	**PARRAMATTA**	**689 2188**
	The Gateway, High & Henry Sts	**PENRITH**	**32 3400**
	818 George St	**RAILWAY SQ**	**211 3777**
	6 Bridge St	**SYDNEY**	**27 5051**
	125 York St	**SYDNEY**	**267 9111**
	Tamworth Acde & Kable Ave	**TAMWORTH**	**66 1961**
	263 Keira St	**WOLLONGONG**	**28 3800**
ACT	96 Gladstone St	**FYSHWICK**	**80 4944**
VIC	Creswick Rd & Webster St	**BALLARAT**	**TBA**
	260 Sydney Rd	**COBURG**	**383 4455**
	Nepean Hwy & Ross Smith Ave	**FRANKSTON**	**783 9144**
	205 Melbourne Rd	**GEELONG**	**78 6766**
	399 Lonsdale St	**MELBOURNE**	**67 9834**
	Bridge Rd & The Boulevarde	**RICHMOND**	**428 1614**
	Springvale & Dandenong Rds	**SPRINGVALE**	**547 0522**
QLD	293 Adelaide St	**BRISBANE**	**229 9377**
	166 Logan Rd	**BURANDA**	**391 6233**
	Gympie & Hamilton Rds	**CHERMSIDE**	**359 6255**
	Cnr Gold Coast Hwy & Welch St	**SOUTHPORT**	**32 9033**
	Bowen & Ruthven Sts	**TOOWOOMBA**	**38 4300**
	Ingham Rd & Cowley St. West End	**TOWNSVILLE**	**72 5722**
SA	Wright & Market Sts	**ADELAIDE**	**212 1962**
	Main South & Flagstaff Rds	**DARLINGTON**	**298 8977**
	Main North Rd & Darlington St	**ENFIELD**	**260 6088**
WA	Wharf St & Albany Hwy	**CANNINGTON**	**451 8666**
	William St & Robinson Ave	**PERTH**	**328 6944**
	Centreway Acde, Hay St	**PERTH**	**321 4357**
TAS	25 Barrack St	**HOBART**	**31 0800**

STORE HOURS

All Dick Smith stores are open for trading during the normal trading hours for their particular area (either 9 – 5.30 or 8.30 – 5). Many stores are also open for late night trading. Please ring the store concerned for their particular hours.

welcome here

Terms available to approved applicants through...

100% AND PROUD OF IT'

MAJOR RESELLERS

● **Atherton Qld**: Maarten's Music Centre, 55 Main St 91 1208 ● **Ballina NSW**: A. Cummungs & Co. 91-93 River St 86 2285 ● Broken Hill NSW: Hobbies & Electronics, 37 Oxide St. 88 4098 ● **Cairns Qld**: Electronic World Shop 27 K-Mart, Westcourt Plaza, Mulgrave Rd. 51 8555 ● **Cairns Qld**: Thompson Instrument Services, 79-81 McLeod St 51 2404 ● **Campbelltown NSW**: Fishers 'Chip' Shop, Shop 3, 274-276 Queen St, 27 1475 ● **Coffs Harbour NSW**: Coffs Harbour Electronics, 3 Coffs Plaza, Park Ave 52 5684 ● **Darwin NT**: Ventronics, 24-26 Cavanagh St 81 3491 ● **Deniliquin NSW**: Deni Electronics, 220 Cressy St 81 3672 ● **East Maitand NSW**: East Maitland Electronics 99 High St 33 7327 ● **Echuca Vic**: Webster Electronics 220 Packenham St ● **Geraldton WA**: KB Electronics & Marine, 361 Main Terrace 21 2176 ● **Gladstone Qld**: Purely Electronics Shop 2 Cnr Herbert & Auckland Sts 72 4321 ● **Gosford NSW**: Tomorrows Electronics & Hi Fi 68 William St 24 7246 ● **Inverell NSW**: Lyn Willing TV 22A Evans St 22 1821 ● **Katherine NT**: Cascade Electronics Shop 7 Commonwealth Bank Acde 72 2564 ● **Kingston Tas**: Kingston Electronics Channel Court 29 6082 ● **Launceston Tas**: Advanced Electronics 5A The Quadrant 31 7075 ● **Lismore NSW**: Decro Electronics 3A/6-18 Carrington St 21 4137 ● **Mackay Qld**: Stevens Electronics 42 Victoria St 51 1723 ● **Maryborough Qld**: Keller Electronics 218 Adelaide St 21 4559 ● **Mt Gambier SA**: Hutchesson's Comm. 5 Elizabeth St 25 6404 ● **Mildura Vic**: McWilliams Electronics 173 Summer St 62 6491 ● **Port Macquarie NSW**: Hall of Electronics 73 Horton St 83 7440 ● **Rockhampton Qld**: Purely Electronics 15 East St 21 058 ● **Shepparton Vic**: G.V. Electronics Centre 189B Corio St 21 8866 ● **Southport Qld**: Amateurs Paradise 121 Nerang St 32 2644 ● **Toowoomba Qld**: Hunt's Electronics 18 Neil St 32 9677 ● **Townsville Qld**: Tropical TV 49 Fulham Rd. Vincent Village 79 1421 ● **Wagga NSW**: Wagga Wholesale Electronics 89 Forsyth St ● **Whyalla SA**: Mellor Enterprises Shop 2 Forsythe St 45 4764

SPEEDY PHONE/BANKCARD ORDER SERVICE

Just phone your order and Bankcard details - it's so simple!

(02) 888 2105

ORDER ONLY ON THIS NUMBER

ENQUIRIES: (02) 888 3200

HEAD OFFICE AND MAIL ORDER CENTER:
P.O. Box 321, NORTH RYDE, NSW 2113.
TEL. (02) 888 3200

POST & PACKING CHARGES

ORDER VALUE	CHARGE	ORDER VALUE	CHARGE
$5.00 - $9.99	$2.00	$50.00 - $99.99	$5.00
$10.00 - $24.99	$3.00	$100.00 or more	$6.50
$25.00 - $49.99	$4.00		

Charges are for goods sent by post in Australia only – not airmail, overseas or air freight.

Dear Customers,

Quite often, the products we advertise are so popular they run out within a few days. Or unforeseen circumstances might hold up shipments so that advertised lines are not in the stores by the time the advert appears. And very occasionally, an error might slip through our checks and appear in the advert (after all, we're human too!). Please don't blame the store manager or staff: they cannot solve a dock strike on the other side of the world, nor fix an error that's appeared in print. If you're about to drive across town to pick up an advertised line, why not play it safe and give them a call first . . . just in case!
Thanks.

Dick Smith & Staff

CONSIDER THE ADVANTAGES OF SHOPPING BY MAIL ORDER..

* Lightning Fast Service - our fully computerised mail order centre will have your goods speeding back to you within 24 hours of receipt - maximum! (Normally, they're even quicker!)

* Special 14 day Satisfaction Guarantee - our normal 7 day Satisfaction Guarantee is extended to 14 days for mail order customers: If you're not absolutely delighted, return your purchase within 14 days (in original condition) for a full refund. What can you lose?

* New products, mail-order-only specials, etc: as a mail order customer, you'll receive up to 6 bargain packed mailers per year AND, from time to time, special offers for mail order customers only (not even available from our stores!)

* Above all, our 15 years of reliable mail order experience. You know when you send us an order we'll be around to serve you: some mail order companies have given the industry a bad name, but Dick Smith Electronics sets the high standards others try to match. You can trust Dick Smith Electronics.

DICK SMITH Electronics

DSE/A701/PA

RITRONICS WHOLESALE PTY LTD

1st floor 425 High St. Northcote 3070 (03) 489 7099 (03) 481 1923 Telex AA 38897

YOU WILL NEVER HAVE TO PAY FULL PRICE FOR COMPONENTS AGAIN
COMPUTER PAPER 9″ x 11″ 2000 SHEETS $29.50 + TAX A BOX.

MAIL ORDER TO P.O. BOX 235, NORTHCOTE 3070.

M4851 500K **$260 + tax.**

M2896-63 **THE MITSUBISHI RANGE OF DISK DRIVES**

Slimline 8″ Disk Drive, Double Sided, Double Density, No AC Power required, 3ms track to track, 1.6 mbytes unformatted, 77 track/side, 10⁹ bit soft error rate.

$495 + tax. Box & Power supply to suit $105 + tax

M2894

Standard size 8″ drive, Double sides, double density, 3ms track to track access, 1.6 mbytes unformatted, 77 track/side, 10⁸ bit soft error rate.

$475 + tax. Box & Power supply $105 + tax

M4854

Slimline 5¼″ disk drive, Double sides, double density, 96 track/inch, 9621 bits/inch, 1.6 mbytes unformatted, 3ms track to track access, 77 track/side.

$315 + tax. Box & Power supply $75 + tax

M4853

Slimline 5¼″ disk drive, Double sides, double density, 1 mbyte unformatted, 3ms track to track, 80 track/side, 5922 bits/inch, Steel band drive system.

$295 + tax. Box & Power supply $75 + tax

HI TECHNOLOGY PRODUCTS AND EXPERIENCE

LINEAR REGULATORS

UA309KC	1.40
UA317KC	1.95
UA317UC	1.20
UA494PC	2.60
UA723PC	0.50
LM396K	15.00
UA7805KC	1.20
UA7805UC	0.60
UA7808UC	0.60
UA7812KC	1.20
UA7812UC	0.50
UA7815KC	1.20
UA7815UC	0.50
UA7818KC	1.00
UA7818UC	0.60
UA7824KC	1.20
UA7824UC	0.60
UA78L05AWC	0.27
UA78L12AWC	0.27
UA78S40DC	3.50
UA7905KC	1.20
UA7905UC	0.60
UA7908KC	1.20
UA7908UC	0.50
UA7912KC	1.20
UA7912UC	0.60
UA7915KC	1.20
UA7915UC	0.50

2N3055	0.55
BU126	1.40
BU326	2.00
BUX80	2.30
2N3771	2.50
2N3772	2.50
2N3773	2.50
FND500	1.10
FND507	1.10
MAN74A	1.90
MAN72A	1.90
4N28	0.60
4N33	0.70
BDV64B	2.00
BDV65B	2.00
AD149	1.50
2SK134	3.50
2SJ49	3.50
W02	0.20
W04	0.25
IN5401	0.10
IN5404	0.12
BC547	0.05
BC548	0.05
BC549	0.05
C122D	0.65
SC141D	0 .90
BU208	1.50

Z80A CPU	$3.60
Z80 CTC	$3.20
Z80A CTC	$3.95
Z80 P10	$2.90
Z80A P10	$3.40
Z80 S10	$8.00
Z80A S10	$10.00
6800	$3.90
6802	$4.90
6809	$10.60
6821	$2.50
6840	$3.50
6845	$8.90
6850	$1.75
8212	$1.50
8216	$1.50
8224	$1.70
8255	$2.90
8155	$4.90
4011	$0.20
4016	$0.45
4017	$0.50
4023	$0.40
4028	$0.45
4040	$0.52
4051	$0.49
4066	$0.50
4081	[illegible]
4511	$0.80
4520	$0.55
74LS00	$0.18
74LS04	$0.18
74LS14	$0.19
74LS30	$0.20
74LS32	$0.25
74LS47	$0.34
74LS90	$0.26
74LS161	$0.33
74LS240	$1.00
74LS244	$1.50
74LS245	$1.50
74LS366	$0.45
74LS367	$0.40

HYBRID REGULATORS

SH1605	9.50
SH323C 3ASV	4.50
UA78H05SC 5ASV	5.50
UA78H12SC 5A12V	6.00
UA78HGSC 5A variable	6.20
UA79HGSC	10.00
UA78PO5SC 5A10V	12.50

MEMORY SPECIALS

27C16	CMOS PROM	$9.50
27C32	CMOS PROM	$12.50
58725	2Kx8 RAM	$4.50
2716	500NS	$3.95
2732	450NS	$4.50
2764	250NS	$7.00
4164	150NS	$6.50
	per 100 + @	$6.00
27128		$28.00 + tax
1771		$15.00
1791		$25.00
1793		$25.00
Z80 CPU		$3.40

TRANSISTORS

BD139	0.23
BD140	0.23
MJ802	2.40

	1-9	10-99	100+
AA Nicads	1-60	1-50	1-30

	1-99	100-999	1000+
IN 4001	5-00	4-00	3-50
IN 4004	6-00	5-00	4-00
IN 4007	10-00	8-00	5-00

SCOTCHCAL RANGE OF PHOTOSENSITIVE PRODUCTS.

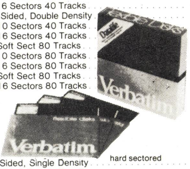
			Per Sheet	Per Box
8001	Red on Aluminium	250mm x 300mm	$6.50	$45.00 (10sh)
8001	Red on Aluminium	300mm x 600mm	$10.00	$48.00 (5sh)
8005	Black on Aluminium	250mm x 300mm	$6.50	$45.00 (10sh)
8005	Black on Aluminium	300mm x 600mm	$10.00	$48.00 (5sh)
8009	Blue on Aluminium	250mm x 300mm	$6.50	$45.00 (10sh)
8009	Blue on Aluminium	300mm x 600mm	$10.00	$48.00 (5sh)
8007	Reversing Film	250mm x 300mm	$ 4.00	$22.50 (10sh)
8007	Reversing Film	300mm x 600mm	$ 8.50	$30.00 (5sh)
8011	Red on White Plastic	250mm x 300mm		$48.00 (10sh)
8013	Black on Yellow Plastic	250mm x 300mm		$48.00 (10sh)
8015	Black on White Plastic	250mm x 300mm		$48.00 (10sh)
8016	Blue on White Plastic	250mm x 300mm		$48.00 (10sh)
8018	Green on White Plastic	250mm x 300mm		$48.00 (10sh)
8500	1 Litre Developer			$9.00 per bottle
8500	250ml Developer			$2.50 per bottle
3900	Scotch Clear Finish	368gm Aerosol		$10.00 per can

All prices plus Sales Tax. Dealer and Trade inquiries welcome.
Please note full range of products are available on order.
Please contact Tim Bray on (03) 489-7099 for further information.

**10% off all Verbatim Disc prices for February.
Offer ends Feb 29, 1984.**

VERBATIM DISCS
5 YEAR DATALIFE GURANTEE

			Per Box of 10
MD525-01	Single Sided, Double Density	soft sectored	$35.00
MD525-10	SSDD 10 Sectors 40 Tracks		43.00
MD525-16	SSDD 16 Sectors 40 Tracks		43.00
MD550-01	Double Sided, Double Density		51.00
MD550-10	DSDD 10 Sectors 40 Tracks		51.00
MD550-16	DSDD 16 Sectors 40 Tracks		51.00
MD577-01	SSDD Soft Sect 80 Tracks		51.00
MD577-10	SSDD 10 Sectors 80 Tracks		57.00
MD577-16	SSDD 16 Sectors 80 Tracks		57.00
MD557-01	DSDD Soft Sect 80 Tracks		63.00
MD557-16	DSDD 16 Sectors 80 Tracks		63.00



8″ VERBATIM

FD32-1000	Single Sided, Single Density	hard sectored	43.00
FD32-8000	Single Sided, Double Density		54.00
FD32-9000	SSDD Critically Certified		53.00
FD34-1000	Single Sided, Single Density	soft sectored	43.00
FD34-8000	Single Sided, Double Density		51.00
FD10-4008	Double Sided, Single Density		59.00
FD10-4015	Double Sided, Single Density		59.00
FD10-4026	Double Sided, Single Density		59.00
FF32-2000	SD FLIPPY FLOPPY		62.00
FF34-2000	SD FLIPPY FLOPPY		62.00
DD32-4000	Double Sided, Double Density	hard sectored	53.00
DD34-4001	Double Sided, Double Density		53.00
DD34-4008	Double Sided, Double Density		53.00
DD34-4015	Double Sided, Double Density		55.00
DD34-4026	Double Sided, Double Density		55.00

Single Disc Packs 10% Extra

ALL PRICES +20% S.T.

100MHz Probe Sets, great value @ . . . . . $25.00 + Tax

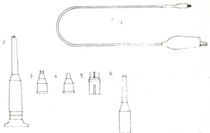
Greenpar

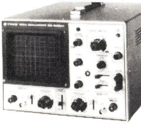
PROBE ACCESSORIES

Standard Kit

Items 1-6 are standard accessories supplied where appropriate with probe kits.

1. Earth lead and clip 6″.
2. Retractable hook.
3. I.C. test tip.
4. Tip insulator.
5. BNC adaptor.
6. Trimming tool.





TRIOS

CS1560
ALL CROS.
$439.00
+ Tax

ALL PRICES PLUS 20% TAX. TRANSISTORS PLUS 32.5% TAX.
MIN POST $3.00 Heavy Items Extra

FAIRCHILD DISTRIBUTORS.

RITRONICS WHOLESALE PTY LTD

MAIL ORDER to PO Box 235, Northcote 3070 Victoria. **Minimum MAIL ORDER $20.00**

MAIL ORDER MAIL ORDER MAIL ORDER

MAIL ORDER MAIL ORDER MAIL ORDER

For Sale/Wanted/Swap/Join

MINI-MART

COMPUTERS

Z80 BUSINESS SYSTEM: 12-slot S100 motherboard with 64K, 2x8" disks (total 2M), beehive DM5A green screen, Epson MX100, software, $2995. (03) 598-8129 ah.

VIC-20 program library: High quality games, utility, educational and miscellaneous programs available. Send SAE to Chris Groenhout, 25 Kerferd St, Watson ACT 2602 for list.

FOR SALE: DREAM 6800, 4K RAM, sound generator, in-built cassette, joystick, remote keypad, 60 programs on tape, full documentation, choice of 12", 20" B/W monitor, $110 ono. (02) 31-6064.

ACT VIC-20 bimonthly magazine: Many interesting articles and programs. February issue $2. Bimonthly $12 per year. Write to Christ Groenhout, 25 Kerferd St, Watson ACT 2602.

BOOKS: 'VIC Innovative Computing', $12. '50 outstanding programs for the VIC-20', $14. B. Begg, 18 Sturt Ave, Toorak Gardens, SA.

COMMUNICATIONS

FOR SALE: MARCONI synchronising video pulse unit, two channels, type 61358. Swap for communications or SW receiver, older type IGC also considered. W. Jongeneelen. (046) 84-1061.

FOR SALE: STC base and mobile radio phone MTR25/151A, 25 W FM 73.115 MHz, selective call, excellent condition, $600. J. Farrington, 9 Byron St, Bellambi, NSW 2518. (02) 84-3388.

MISCELLANEOUS

VALVES FOR SALE: Many popular and rare types. 1S2, 6AL5, 6CM5, 6BX6, 6CA4, 6BA6, 1AC6, 6AJ8, 6AL3, 6BQ7A and many more. Phone for prices Salvatore (02) 660-5120 ah.

FOR SALE: GRESHAM UK picture line up test generator, $40. Astor PB1-03 pulse and bar generator, $52. Both in 9" case. Or swap both for DMM. W. Jongeneelen. (046) 84-1061.

WANTED: COPY of 'Pal Television Servicing' by Patchett. M. Magill, 40 Leber St, Warrandyte, Vic 3113. (03) 844-3035.

FOR SALE: MODEL 33 teleprinter, $60 ono. Chas, Blaxland. (047) 39-2464.

WANTED: ASR 33 manual. Good price paid. E. Plunkett, 7 Hill St, Eugowra, NSW 2806. (068) 59-2472.

- We'll publish up to 24 words (maximum) free of charge for you, your club or your association. Copy **must** be with us by the 1st of the month preceding the month of issue. Please — **please** — print or type advertisements clearly, otherwise it may not turn out as you intended! Every effort will be made to publish all advertisements received; however, no responsibility for so doing is accepted or implied. Private advertisements only will be accepted. We reserve the right o refuse advertisements considered unsuitable.
- **Conditions:** Your name and address plus phone number (if required) must be included with the 24 words. Reasonable abbreviations, such as 25 W RMS or 240 Vac, count as one word. Advertisements must relate to electronics, audio, communications, computing, etc — general advertisements cannot be accepted.

Send your advertisement to: **ETI Mini-Mart,**
P.O. Box 227,
Waterloo NSW 2017.

FOR SALE: Hewlett-Packard 1742A 100 MHz oscilloscope with in-built DVM, delayed sweep, delta time and extra probes. In mint condition, $2200 ono. (047) 35-2360 ah.

FOR SALE: HP-32E calculator. Full scientific and hyperbolic functions, excellent condition with box and manuals plus recharger, $35. Salvatore (02) 660-4120 ah.

BACK ISSUES, SUBSCRIPTIONS, BINDERS AND PHOTOCOPIES

Send orders to: **ETI Reader Services, PO Box 227, Waterloo, NSW 2017, Australia.**

☐ BACK ISSUES $2.50 each, available from Nov 1978

Month ....Year...........$ ....
Month ....Year...........$ ....
Month ....Year...........$ ....

Please attach a list if more than three required.

☐ PHOTOCOPIES $2.50 per article per issue

Project No ....Month ....Year...........$ ....
Project No ....Month ....Year...........$ ....
Project No ....Month ....Year...........$ ....

Please attach a list if more than three required.

☐ SUBSCRIPTIONS

$20.00 for one year (12 issues) in Australia $ ....
$26.00 for one year (12 issues) in New Zealand $ ....

Other rates on application.

☐ BINDERS $7.80 each

No .... $ ....

TOTAL $ ________

All prices include postage and packaging.
Tick box to indicate payment:
American Express† ☐ Bankcard† ☐
Cheque* ☐ Money Order* ☐

†Minimum credit card order, $10.
*Please make cheques and money orders payable to the Federal Publishing Company Pty Ltd.

Credit Card No: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Card Expiry Date: ________

Name ________

Address ________

________ Postcode ________

Signature ________

Unsigned orders cannot be accepted.

DREGS

MICRO WAS A real-time operator and dedicated multi-user. His broad-band protocol made it easy for him to interface with numerous input/output devices, even if it meant time-sharing.

One evening he arrived home just as the sun was crashing, and had parked his Motorola 68000 in the main drive (he had missed the S100 bus that morning), when he noticed an elegant piece of liveware admiring the daisy wheels in his garden. He thought to himself, "She looks user-friendly, I'll see if she'd like an update tonight."

Mini was her name, and she was delightfully engineered with eyes like COBOL and a Prime mainframe architecture that set Micro's peripherals networking all over the place.

He browsed over to her casually, admiring the power of her twin, 32-bit floating point processors, and enquired "How are you, Honeywell?" "Yes, I am well," she responded, batting her optical fibres engagingly and smoothing her console over her curvilinear functions.

Micro settled for a straight line approximation. "I'm stand-alone tonight," he said. "How about computing a vector to my base address, I'll output a byte to eat, and maybe we could get offset later on."

Mini ran a priority process for 2.6 milliseconds then transmitted "8K, I've been dumped myself recently, and a new page is just what I need to refresh my disks. I'll park my machine cycle in your background and meet you inside." She walked off, leaving Micro admiring her solenoids and thinking, "Wow, what a global variable, I wonder if she'll like my firmware."

They sat down at the process table to a top of form feed of fiche and chips and a bucket of Baudot. Mini was in conversational mode and expanded on ambiguous arguments while Micro gave occasional acknowledgements although, in reality, he was analysing the shortest and least critical path to her entry point. He finally settled on the old 'would you like to see my benchmark subroutine', but Mini was again one step ahead.

Suddenly she was up and stripping off her parity bits to reveal the full functionality of her operating system software. "Let's get BASIC, you RAM," she said. Micro was loaded by this stage, but his hardware polling module had a processor of its own and was in danger of overflowing its output buffer, a hang-up that Micro had consulted his analyst about. "Core," was all he could say.

Micro soon recovered, however, when she went down on the DEC and opened her device files to reveal her data set ready. He accessed his fully packed root device and was just about to start pushing into her CPU stack, when she attempted an escape sequence.

"No, no!" she piped. "You're not shielded."

"Reset, baby," he replied. "I've been debugged."

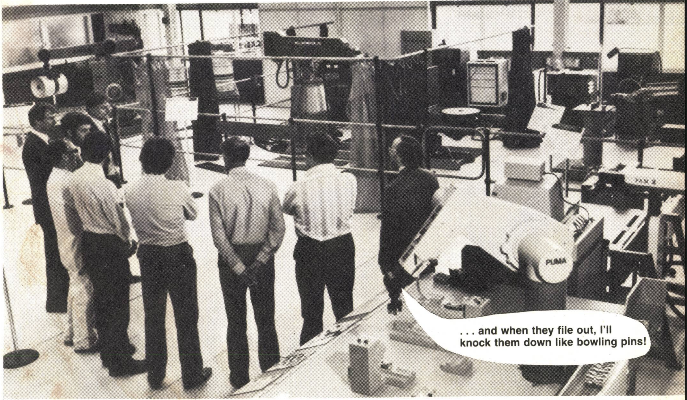
"But I haven't got my current loop enabled, and I can't support child processes," she protested.

"Don't run away," he said, "I'll generate an interrupt."

"No that's too error prone, and I can't abort because of my design philosophy."

Micro was locked in by this stage though, and could not be turned off. But she soon stopped his thrashing by introducing a voltage spike into his mains supply, whereupon he fell over with a head crash and went to sleep.

"Computers," she thought as she compiled herself, "all they ever think of is hex." ●


PUMA
... and when they file out, I'll knock them down like bowling pins!

For champion performance from compact discs,

look to the audio giants.

Totally faithful sound reproduction is no longer out of reach.

Thanks to Sanyo's compact disc technology, a quantum leap into the future of audio enjoyment.

Ask to hear a demonstration of Sanyo's CP 300 Compact Disc Player. The sound quality you'll experience from the 12cm, up to an hour-long, one-sided compact disc is identical to that of the original digital master tape.

Examine the unit carefully. You'll find winning features like horizontal slide loading system; soft-push microcomputer controls; 16-selection programmable auto-search system; and synchronous recording to name a few.

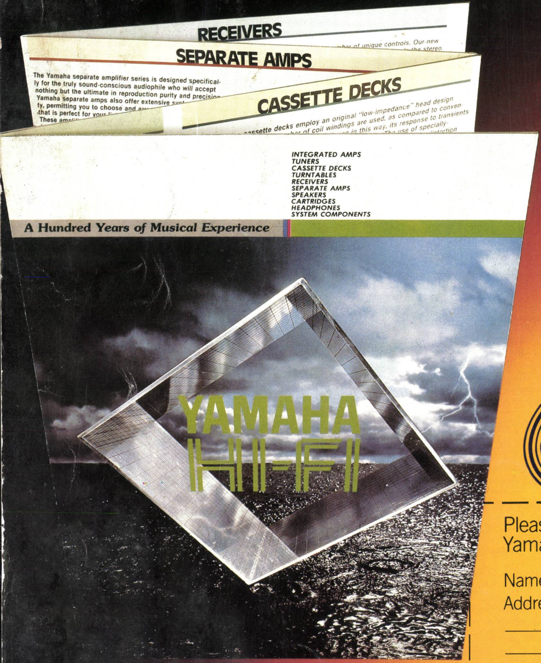
Already, this digital audio technology using laser optics is transforming the audiophile's world, with the kind of champion performance from compact discs that only the audio giants can deliver.

But with Sanyo, that's life.

SANYO

That's Life!

The range of Hi-Fi equipment you thought was beyond your means is now within your grasp.


RECEIVERS
SEPARATE AMPS
The Yamaha separate amplifier series is designed specifically for the truly sound-conscious audiophile who will accept nothing but the ultimate in reproduction purity and precision
CASSETTE DECKS
INTEGRATED AMPS
TUNERS
CASSETTE DECKS
TURNTABLES
RECEIVERS
SEPARATE AMPS
SPEAKERS
CARTRIDGES
HEADPHONES
SYSTEM COMPONENTS
A Hundred Years of Musical Experience
YAMAHA
HI-FI

5
FIVE YEAR WARRANTY

Please send me the latest Yamaha Hi-Fi catalogue.

Name ____________________
Address ____________________
____
__________ Postcode __________

YAMAHA

Yamaha Hi-Fi Division, Rose Music Pty. Ltd.,
17-33 Market St., South Melbourne. Victoria. 3205.

MCR/RM3861E/R